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The Baking Load

MANY are the possible applications of electricity that are from time to time commended to the notice of engineers and managers of supply undertakings. That they should take full advantage of the opportunities presenting themselves to an ever-increasing extent for exploiting profitable outlets is to-day one of the prime necessities for the progress of our industry.

A load that is worth especial attention is provided by baking. We emphasise the need for this especial attention because an oven has a long life, and a chance of electrification missed, when a new oven is to be installed or an old one is to be replaced, is likely to be lost if not for ever then for a great number of years.

If the potentialities of the baking load are tackled in a similar way to that in which our more progressive undertakings are now handling the domestic load, the next few years should see a very great advance. An indication of the tendency is the way in which firms with established reputations as builders of fuel-fired ovens are adapting their productions to meet the future demand; last autumn at the Bakers' Exhibition we noticed that electric ovens were included in the display of at least five such firms in addition to those shown by the primarily electrical firms which have done such valuable pioneering work and which formerly stood alone under the electric flag. We have ourselves on several occasions discussed bread baking by electricity with master bakers and have found them, without exception, enthusiastic regarding the improved product and the overall savings to be obtained by the use of electricity. In no application of electricity is the truth of the saying "It is not what it costs but what it saves" more manifest. When discussing costs it is most important to keep in view that the baker is ultimately interested only in his overall charges from the sack of flour to the bread delivered to the customer. The cost of energy consumed per sack is of relatively small importance compared with the savings known to be obtainable in other ways. The value of the more obvious benefits accompanying the use of electricity, such as cleanliness, healthy working atmosphere, saving in space (due partly to the elimination of fuel and ash storage), easy temperature regulation, and a continuous process (without intervals for refiring) are now generally recognised. There are, however, other advantages which only experience can show to be obtainable. To take an example at random, we are told that one baker finds that he can finish his baking three hours earlier with fewer men since the installation of electric ovens; this has enabled him to arrange his deliveries so that he can dispense with one van even with an increased trade. A satisfied consumer is the best propagandist, but individual recommendations should be co-ordinated for use to the best effect by engineers who have studied the problems from the consumer's standpoint. Cost of electricity must be low; the baking load is off-peak and likely to remain so. Tariffs should therefore be designed with this in view,

and also with regard to the great desirability of offering a rate to cover not only baking ovens but also water-heating, dough-mixing, and other power purposes.

The Perfect Woman

THE industry must open its arms wide to the women if it means to accelerate the pace of domestic electrical development. They can contribute valuable service in many ways for which mere man is not qualified. In recent years the old reluctance, and shall we say fear or suspicion, have been flung to the winds by many of us, and opportunities have been created for women demonstrators and saleswomen in showrooms and as household canvassers to convince the members of their own sex concerning the usefulness and other merits of electricity. And now having welcomed the women to our aid on the sales staffs of supply undertakings, we must afford them the best training facilities so that they may reach a high standard of efficiency. The British Electrical Development Association, the Electric Lamp Manufacturers' Association, and the Electrical Association for Women, have set themselves the task of producing the perfect woman. They have organised the "Women's Electric Service Course" (see our "Business Notices" to-day) which takes place at the E.L.M.A. Lighting Bureau in London from April 14th to 16th. In drawing attention to the course we appeal to the ladies to give their enthusiastic co-operation. The presence amongst us of a large number of well-equipped electrical women might go far to change the attitude of mind of still unconvinced supply engineers and committees.

The Jointer's Mate

THE plumber-jointer's mate is often penalised for being a good man. He is seldom given an opportunity for advancement because in his present capacity he is, at the moment, much more useful. This policy is a narrow one and not fair to the man. The mate is usually a very carefully selected employé and is given his position permanently after being tried for his capacity of undertaking responsibility and making quick decisions. While the jointer is in the hole the mate assumes control and often has the say as to how long the "juice" can be off and whether there is time to do a job before the supply is wanted. In time of trouble the "old stager" is instinctively an excellent fault finder and often literally "smells them down." A wise jointer will often wait for the tip from his mate as to where to open up. More important still, however, is the vexed question of metal consistency and "heat," and almost invariably the "technique" of this matter is solely the mate's affair. How often is a good mate specially selected to work with a doubtful new jointer or a young prospective jointer to "see him through." This practice is quite legitimate and a good one, but after ten or more years the good mate is worth a reward—and he would make a good jointer.

Domestic Lighting

LAST week the lighting engineer was counselled to seek guiding principles from the more generally acknowledged successful examples of recent installations. For the purpose of such study it is desirable to select specimens from the many different classes ordinarily met with in practice, the one that naturally occurs first to one's mind being domestic lighting. Dr. J. W. T. Walsh's contention is that the fittings used to house the lamps should so harmonise with the general furnishings of the room that their removal would spoil the general effect just as much as the removal of an important piece of furniture would do; and he is right, for the contrast between the cheerfulness of a room really well lighted and another in which a single fitting suspended from the centre of the ceiling provides the whole of the illumination is very marked. Luminous decorative ornaments, though not strictly lighting fittings, do legitimately come within the scope of the subject, since they are of considerable value in the restrained use of colour. Artificial light is no longer a luxury. It is probably one of the cheapest things we buy, and electric light is now obtainable at a cost which enables it to be used in greater quantities, as Mr. H. T. Young has pointed out, not only from the purely utilitarian aspect of higher intensities, but also as a stimulant, a definite decorative asset in our homes. Incidentally, its cost compares most favourably with that in all other countries, added to which we have greater reliability and better quality, meaning steadier light resulting from more constant voltage.

The Heating of Buildings

IT is quite impossible in a brief report to deal adequately with the very comprehensive paper on the Electrical Heating of Buildings which Mr. Ronald Grierson read before the I.E.E. last week. Those interested in this important subject cannot afford to miss a careful study of the entire paper. We must, however, agree with some speakers in the discussion that the section of the paper dealing with the thermal storage system does less than justice to the merits of that system. The "heat losses," even if they are as much as 25 per cent. and upwards of the total, as the author states, are not really losses to anything like the extent implied; the B.th.u. radiated from the hot water piping serves a very useful purpose in warming the building as a whole. The rates offered by supply undertakings for this load can be low not because this is demanded by the inherent inefficiency of the system, but because rates of the order of 0.3d. per kWh are sound for a night load.

Industrial Depression: Domestic Progress

FURTHER indication that the domestic sphere offers tremendous opportunities to the electrical industry is afforded by the reports of a number of the large supply undertakings. The Newcastle-upon-Tyne Electric Supply Co., Ltd., the Yorkshire Electric Power Co., the Scottish Electric Power Co. and other concerns have found that, while industrial depression has had adverse effects upon their power load, their output has continued to increase by reason of the greater use of electricity in the home. This has naturally had a repercussion upon the manufacturing branch of the electrical industry. In its report for 1930 the B.E.A.M.A. Council recorded increased employment in the sections producing domestic apparatus, while a number of branches supplying industrial plant felt the effects of the prevailing depression. This phenomenon was not a peculiarly British one. Mr. Matthew S. Sloan, president of the New York Edison Co., stated a week or two ago that the large power sales of the American electrical utilities decreased by 8 per cent. during 1930, while "sales to homes" increased by 14 per cent. When the long-awaited revival comes there should be a veritable boom in the electricity supply and electrical manufacturing industries.

Sales Engineers

TWO speeches delivered last week indicate the importance that is attached by representative members of different sections of the electrical industry to the qualifications of those who act as intermediaries between the producer and the public. Mr. C. C. Paterson, president of the I.E.E., and Mr. A. V. Sendall, immediate past-president of the E.P.E.A., whose remarks are reported on a later page, both emphasised the need for young engineers to consider the prospects of careers as technical salesmen. We would strongly support the views expressed, but would point out at the same time that the possession of technical knowledge alone is not enough to ensure success. Salesmanship must be learned as an addition to ordinary qualifications.

Co-operation with Architects

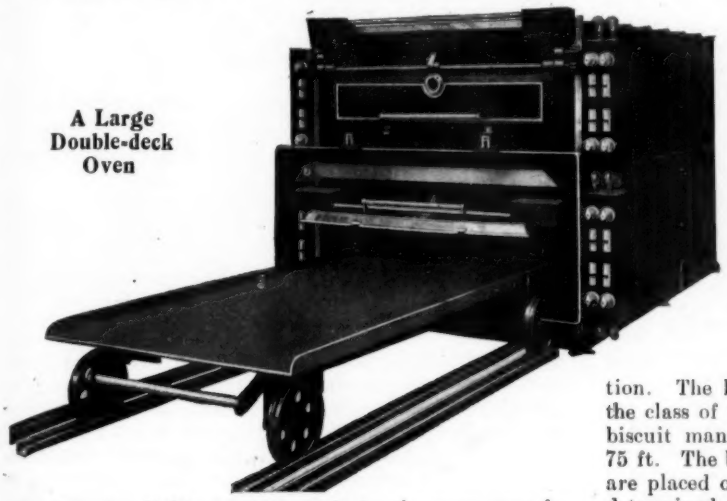
THE need for closer co-operation between illuminating engineers and architects has often been urged in these columns. It is gratifying to record that the school of the Architectural Association is embodying a study of electric lighting in its curriculum, the lectures being given by the technical staff of the E.L.M.A. Service Bureau. Those entering the profession of architecture will thus have a sound grounding in the principles of illumination with beneficial results.

Baking Ovens

An Opportunity to Electrify a Bakery if not Accepted is not Likely to Recur

By THOMAS H. LEAK

THE general construction of an electric oven is heavy-gauge sheet steel, with the interior or baking chamber plain or vitro-enamelled. The sections are made steam-tight to prevent the steam penetrating to the lagging between the inner and outer case, which is also of sheet steel.* Thermometers are provided,



A Large Double-deck Oven

also interior lights so that goods in the oven may be inspected without opening the oven doors. This is an advantage where special goods are being baked, but for general purposes the operatives simply work by the clock, and know exactly when to switch up or down to produce the loaf selling best in their particular district.

The two types of ovens in general use are what are known as peel and drawplate. The former has a tiled sole, and it is necessary to use what is termed as a peel for "setting" and removing the bread after baking. Users of this type of electric oven are in agreement that multiples of the double deck half sack (8 ft. by 4 ft. sole) are the most practical for general purposes.

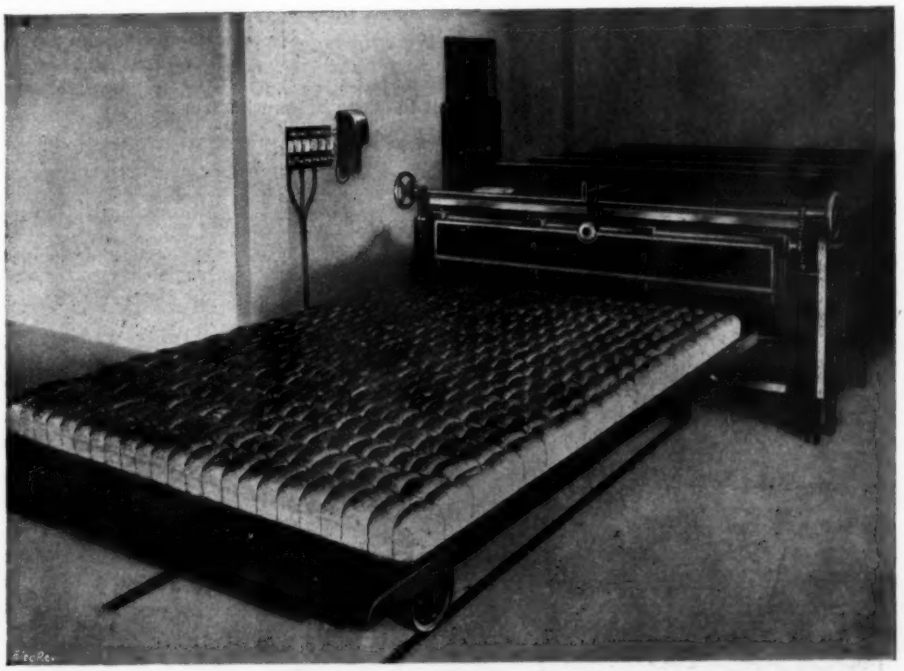
The drawplate has a metal plate or sole; upon this the dough is placed, and it is then run into the oven to be baked. A saving in time is effected with this type, and, where space in front of the oven permits, it is easier for setting and removing the bread.

Here, again, the double-deck half-sack oven is usually the most practicable proposition, but a large size of drawplate, which possesses the advantage that the plate can be withdrawn, is sometimes considered desirable. During the process of loading and unloading, the oven door is closed, thus conserving the heat. Ovens of this description are made with plates 12 ft. 6 in. by 8 ft. 6 in., capable of baking 480 2-lb. Scotch loaves at each setting, the weight of wet dough being over 1,000 lb. A saving of time of 10 to 15 minutes per batch is achieved compared with the side-flue oven. Even larger ovens with plates 15 ft. by 8 ft. 6 in. are in use, so it will be seen the manufacturer is capable of dealing with any size that may be required.

For certain baking purposes, the peel may be preferred to the drawplate type, or *vice versa*. To give the baker with a moderate size of business the dual advantages, a combination of the two types is available. In the construction of this oven the "drawplate" constitutes the lower and the "peel" the upper deck. The foregoing description relates to what is usually termed the "portable" type, as it can be erected or dismantled for re-erection in other premises, if desired. Electric ovens are also made with brick construction in place of the sheet-metal exterior.

A number of bakery firms have been anxious to install what is known as the "travelling oven," but in nearly all cases the price per kWh has prevented its adoption. The length of such an oven varies according to the class of work to be done, and is very popular with biscuit manufacturers. The usual length is 50 ft. to 75 ft. The bread, biscuits, or other articles to be baked are placed on a belt which travels, according to a predetermined rate, to the outlet, where the finished goods are removed. The oven is thermostatically controlled in sections to ensure a perfect product resulting from the even temperature obtained.

Once a baker's oven is installed for any particular fuel, then the opportunity is lost for many years to substitute another type, even if subsequently the prices of competitive fuels are reduced. The capital has been sunk and, therefore, the baker or his successors carry on until such time as a renewal is absolutely necessary. In the general interest of electrical development, therefore, it behoves the supply authority concerned to endeavour to influence the selection of an electric oven whenever a change of oven or a new installation is pending by offering a reasonable rate, which will result in a permanent load, in most cases, during the "off peak"



Bread just Removed from a Draw-plate Oven

* "Electric Breadmaking," Elec. Rev., Feb. 27th, 1931.

period. Many arguments have been put forward from time to time against the granting of special rates, and it therefore may not be out of place to deal with one or two.

(1) *The granting of reduced tariffs would result in a rush of bakers for electric ovens, and mains would become overloaded.*

As already stated, bakers do not often require new ovens, and the opportunity should not be lost to get the first one installed, even if the tariff granted shows little profit—such an installation can be referred to as a satisfactory and commercial proposition when the next inquiry comes along, although this may possibly not be until three or four years after, by which time the copper difficulty will probably have been overcome, and a further load will be welcomed. Presumably generating costs will also be lower. Again, the supply authorities will have obtained their own data, which will be valuable as a guide to rates for future inquiries.

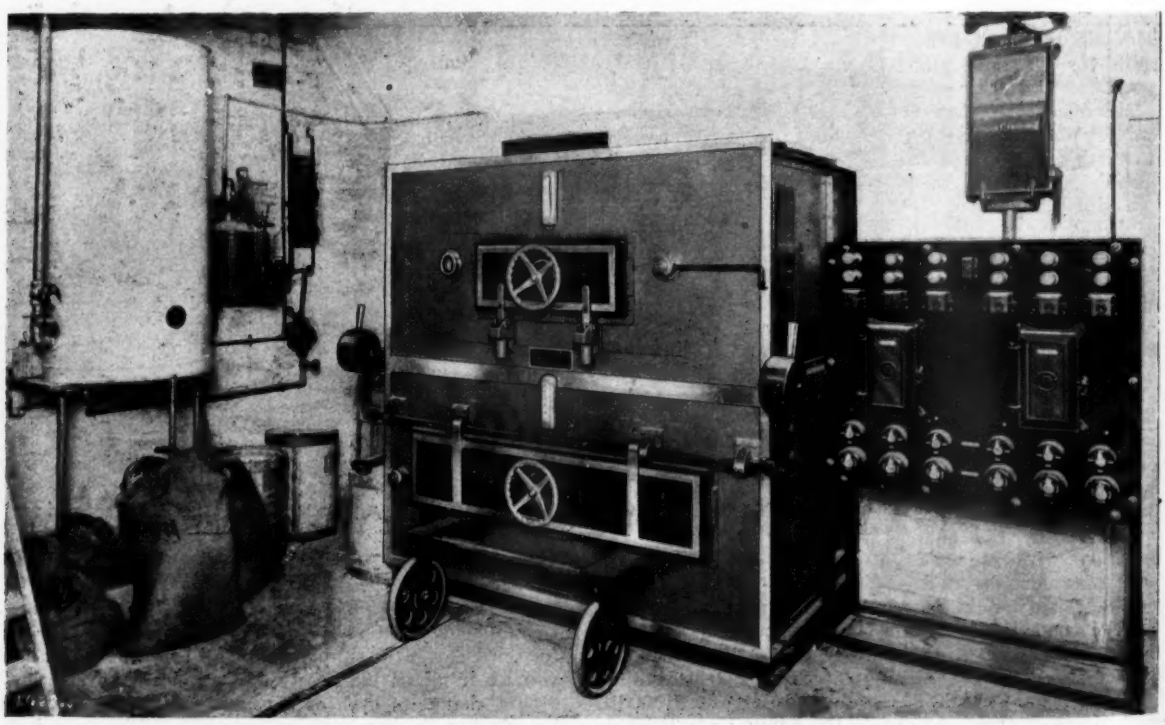
(2) *The granting of reduced tariffs creates a demand from existing consumers with a greater energy consumption than the baker demanding the same terms.*

As the special rates obtained in districts where electric ovens are already installed generally permits the use of current at the low rate between the hours of 9 p.m. and 4 p.m. the following day (the heaviest load being between the former hour and 7 a.m. or 8 a.m. next morning, during which time bread is baked) any request from other consumers can be met with a similar offer if current is also taken during the hours specified.

In other instances local conditions of supply have to be taken into account, and a difficulty often arises with bulk supply, as the kW charge cannot be passed on to the baker if his custom is to be obtained. It has to be remembered that the maximum load of the oven is always used initially for heating-up to baking temperature. A baker may, therefore, be involved in a kW charge of £200 or more per annum, plus his kWh charge, which may render the proposition prohibitive. If night baking only is involved, the load should be welcomed, and the kW charge can usually be waived. In negotiating with the baker the question of the method of charging is an important one. As a layman complicated tariffs have a distinct tendency either to stop entirely or retard the business at the outset. The natural desire of anyone who is willing to consider the installation of electric ovens is to have everything electric, but it is necessary, in order to ensure satisfaction, that an "all-in" rate for the whole, *i.e.*, power and water heating, as well as the ovens, should be quoted. It will be quite clear from the foregoing that each inquiry for special terms will have to be treated on its individual merits. As a general rule, if a manufacturer obtains details from a baker as to his hours of working, probable variations of load, and other operating conditions, and then submits the information to the supply authority, the latter is ready to give the inquiry careful consideration, as it is recognised that a load of this character, once lost, is lost altogether. In a number of areas where electric baking ovens have been installed a standard rate for this class of load is now included in the published schedule of tariffs as a result of experience gained with the first electric ovens installed. It is therefore probable that, in the near future, a baker who is considering electrification will be able to obtain as prompt information regarding the tariff for his business as is obtainable by any other class of consumer.

Peel Oven with Proving Cupboard Below

Whilst a large number of towns throughout the country can now point to the possession of electric bread-baking equipment, with the extension of the grid a greater number of other towns and villages should soon be able to do the same, and, whilst in each case it would only be a unit sale for the manufacturers of baking ovens, it would mean a permanent revenue for the supply authority.



Combined Draw-plate and Peel Oven with an Electric Water Heater as an Adjunct

D.C. Motor Control

The Potentiometer Method of Regulating the Speed of Hoists when Lowering Loads

By W. NORBURN, A.M.I.E.E.

HAVING had several years' experience in teaching the elements of electrical engineering, and thus having learned by hard experience the desirability of first stating fundamentals, the author makes no apology for doing so at the beginning of this paper.

The speed of an electric motor when connected across a given potential difference depends inversely upon the flux entering the armature. Thus for a shunt-wound machine, with a constant flux, the speed will be constant—or nearly so, small variations due to C × R drop and armature reaction with different loads having a small effect.

In the case of a series-wound motor, however, the flux varies with the machine current, and thus a heavy cur-

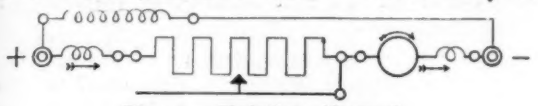


Fig. 1.—Hoisting (Power)

rent, producing a heavy flux, gives a low speed, and, conversely, a light current produces a high speed. It is for this reason that series-wound motors are used for hoisting purposes, *e.g.*, ships' winches, windlasses, and capstans, cranes and foundry hoists, lifts, &c. In order to prevent too great a reduction in the flux, with the attendant dangerously high speed in cases where the load may be entirely removed, it is usual to provide a small amount of shunt field to give a limiting high-speed value.

Effect of Compounding Field

This arrangement gives in practice excellent results for most classes of work, as lighter loads are raised at higher speeds than heavy ones, effecting economy in the time of operation and tending to keep the *rate* of work more constant than a plain shunt-wound motor would. It is obviously impossible to keep this rate constant, as that would entail constant current input and therefore constant speed; which with varying loads does not produce constant work. Certain devices, however, are

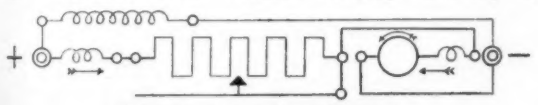


Fig. 2.—Lowering (Power)

available to increase still further the light load speed and so approach more nearly to the ideal condition of constant rate of work.

Armature Driven by Load

When lowering the load, however, a different state of affairs exists. It frequently occurs in practice that the efficiency of the gearing interposed between the motor armature and the hoisting rope barrel is so high that *the load drives* the armature. Even with a shunt limiting-speed winding, the armature revolutions may become dangerously high before the current fed back to the supply mains loads the motor sufficiently to act as an effective brake, and so check the falling load. Most probably the total distance through which the load has to fall would not permit such a braking speed to be attained and still leave sufficient travel to allow for checking by means of the foot or hand brake or other device provided for bringing the load to rest.

The first method to suggest itself is the very simple one of providing an additional shunt winding in order to create sufficient flux to give the braking effect at a reasonable speed of lowering, but this involves providing the normal series and shunt windings for hoisting and this extra shunt coil for lowering, and thus the motor is more expensive to build: in fact, it may be necessary to increase the size of the motor to accommodate the extra coils of wire.

An alternative scheme is to make use of the primary principle that current will flow when a difference of potential exists if there is a suitable path provided. If the motor armature is connected across a difference of potential its speed of revolution can only vary from that value which is required to produce an e.m.f. value equal to the p.d. in question by the amount required to cause a certain current to circulate through the resistance of the complete circuit so produced.

This method is analagous to the potentiometer method of balancing e.m.fs. for the measurement of various quantities and is therefore known as *potentiometer control*.

The usual conditions are, simply, shown in fig. 1 when hoisting. When it is desired to lower the load, *i.e.*, reverse the direction of armature rotation, it is necessary to reverse either (*a*) the direction of the flux, or (*b*) the direction of current flow through the armature in order to produce a torque in the correct direction. As a general rule (*a*) involves changing over the connections of (1) the series field coils and (2) the shunt field coils. The latter change is undesirable. The use of (*b*) however only requires the provision of two terminals (see fig. 2) and is therefore the simpler and more usual.

Balancing the Armature E.M.F.

In order to introduce an e.m.f. or some potential difference against which the armature e.m.f. may be

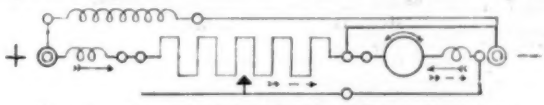


Fig. 3.—Lowering by Means of Potentiometer

" balanced," we can make use of the fact that the current through the series field is produced, and limited, by a resistance, certain points of which are available in order to vary the conditions of running. If, therefore, we connect the armature across any two of these points, as in fig. 3, we have obtained the conditions we are striving for.

It should be noted, however, that this involves having *both* ends of the armature " free," and so requires two extra fingers and drum contacts, whereas by adopting the arrangement shown in fig. 4a only one extra finger point and drum contact is necessary. Unless, therefore, dynamic braking is also being used, the last arrangement will usually be the more economical in space and cost. For hoisting, the " free " armature terminal is connected to the main, and the current flows through it in one sense. For lowering, the point common to resistance and armature is connected to the main, giving the *same* direction of current flow through

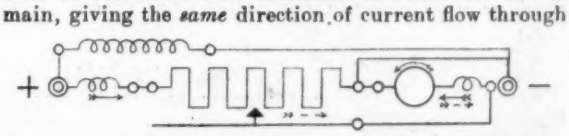


Fig. 4a.—Shunt Field Across Mains (Lowering)

the field, and, therefore, of flux; the free end of the armature goes to some point of the resistance, causing the current flow in the armature to be in the opposite sense, and thus reversing the direction of the torque and so producing rotation in the lowering direction.

In both of these arrangements the shunt field is continuously energised by the full potential, but by adopting the connections as in fig. 4b as the p.d. across the armature is increased that applied to the shunt winding is reduced, and so (by this modification) the speed of rotation is increased whilst retaining the essential feature of a strong field for low speeds as the load is checked and brought to rest. Further, the shunt field circuit is never broken, and so no discharge resistance is required.

When the load *drives* the armature at a speed greater than that necessary to produce an e.m.f. equal to the p.d. across that part of the resistance in parallel with it, a current will flow as shown by the dotted arrows. This will increase the p.d. across this part of the resistance, allowing the armature speed to rise still further. Also, the increased p.d. will cause a reduction in the current through the series field coils, reducing the flux and so the e.m.f. generated, giving a still further increase in speed. This, however, will not be serious in value, but it is preferable to avoid it if possible.

It is therefore suggested that the relative positions in the circuit of the controlling resistance and the series field be reversed, as in fig. 5. An increase in speed above the correct value will cause additional (generated) current to flow through the series coils in the correct sense to increase the flux and so produce an increase in e.m.f.; the greater braking load so created will check the speed of rotation, and a more stable condition will result. Further, as the series coils are connected to the armature it is not necessary to bring out two separate series leads from the machine, so saving one terminal and one cable, and effect a saving in cost thereby.

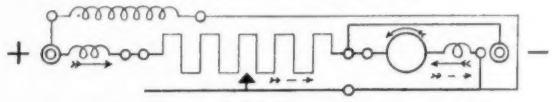


Fig. 4b.—Shunt Field Connected to Armature

Characteristic Relationships

In order to study the behaviour of a machine operating under the conditions outlined above, it is necessary to determine the relationship existing between the various quantities present at any instant. The following symbols are used:—

V_1 = line volts, applied to the system.
C_1 = line current.
C_{se} = series-field current.
C_{sh} = shunt-field current.
C_a = armature current.
R = resistance introduced for control.
R_{se} = resistance of series field coils.
R_a = resistance of armature and interpole coils.
R_p = resistance of path in parallel with armature.
E_g = armature generated e.m.f.
v = voltage across armature and interpole terminals.
r = speed of rotation, r.p.m.
F = flux entering armature, per pole.

The shunt current, being small, is neglected in the following:—

We have $E_g = K \times r \times F$ .....(1)

K being determined from the design particulars of the machine under consideration—

$v = E_g + C_a \times R_a$ + brush drop .....(2)

(Note that C_a will be a positive quantity when the machine is motoring, and negative when it is generating.)

The current flowing in $R_p = C_1 - C_a = v/R$ .....(3)

Therefore $R_p = v/(C_1 - C_a)$ .....(4)

$$v = R_p \times (C_1 - C_a) \quad \ldots\ldots(5)$$

$$V_1 = C_1 \cdot (R - R_p) + R_p \cdot (C_1 - C_a)$$
$$= C_1 \cdot R - C_a \cdot R_p \quad \ldots\ldots(6)$$

$$C_1 \cdot R = V_1 + C_a \cdot R$$
$$C_1 = V_1/R + C_a \cdot R_p/R \quad \ldots\ldots(7)$$

i.e., the line current will be a constant value (determined by the controlling resistance) plus the armature current reduced in the proportion of the total resistance to the part in parallel.

Thus on positions giving low speeds (*i.e.*, when R_p is small) the effect on the line current, whether motoring or generating is small; at high speeds (*i.e.*, when R_p approaches R in value) it is appreciable, especially when the armature current is large.

Neglecting $C_a \times R_a$ as a small quantity (with the usual values of R_a and the armature currents required in operation) excepting for low speeds of rotation; we can write

$$K.r.F = E_g = v = R_p \cdot (C_1 - C_a)$$
$$\therefore r = R_p \cdot (C_1 - C_a) \div K.F. \quad \ldots\ldots(8)$$

Substituting from (8)

$$= \left(\frac{R_p \cdot V_1}{R} + \frac{R_p \cdot C_a \cdot R_p}{R} - R_p \cdot C_a \cdot \right) \div K.F.$$

$$= \frac{R_p}{R} \cdot \left(V_1 - C_a \cdot (R - R_p) \right) \div K.F. \quad \ldots\ldots(9)$$

or $$= \frac{V_1 \cdot R_p}{K\ R.F.} - \frac{C_a \cdot R_p \cdot (R - R_p)}{K.R.F.} \quad \ldots\ldots(10)$$

The speed of rotation thus depends on the ratio of the resistance connected in parallel to the controlling resistance value, and will be affected slightly by a change in armature current. When R_p is small the second part of 10 is small, and when R_p is large $R - R_p$ is small, maintaining the second part of 10 small, in relation to the whole. In practice, the variation of flux, due to change of the current through the series windings, with variation of C_a, is almost balanced by the change in armature reaction.

Speed Variation

When the armature is rotating at the speed required to produce an e.m.f. just enough to balance the drop across the resistance in parallel, the current in it will be zero, and the terminal volts will be exactly $E_g = K.r.F.$ The current through the resistance will be $V_1/R = C_1$, *i.e.*, this portion of the circuit will function as if the armature path were an entirely independent circuit. Referring to (5) we see that $v = C_1 R_p$, and therefore a selected tapping on the resistance will determine the correct speed of rotation, or the speed will be proportional to the value of the resistance in parallel.

We can thus increase this speed from zero, when the armature is short circuited, to the full-load speed, when the armature is across the supply mains, and to higher speeds still by reducing the flux through increasing the value of R. Stability of running is obtained, because a fall in speed will *cause* a flow of current through the armature, and produce motoring torque, at the same time diverting from the series coils and so reducing flux and E_g, and assisting in the production of the current. An increase in speed gives rise to an increase in E_g producing a flow of current as a dynamo, thus acting as a brake, and increasing the current in the field coils with increased flux and E_g, which still further increases the braking effect.

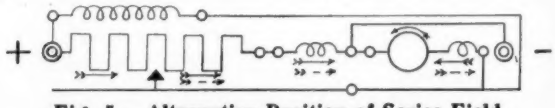


Fig. 5.—Alternative Position of Series Field

It should be noted that a further advantage of this modification is that with the armature short circuited through the series field, but with the machine disconnected from the line, any rotation due to the load falling will cause current to flow through the series field in the correct sense, and the "Off" position of the controller may with advantage provide for this scheme of connections.

The effect of excess speed and the flow of braking current through R_p causes an increased drop of potential across R_p, and therefore a decrease in the potential across the remainder of the resistance $(R - R_p)$. This means that the current through this part, *i.e.*, C_1, is reduced; the nett effect therefore is equivalent to partial regeneration, a condition which is not obtained by dynamic braking schemes.

Street Lighting in France

Apparently with the approval of the municipal authorities, the Comitè Français de l'Eclairage et du Chauffage is arranging for the establishment of a "street laboratory" near the Bois de Boulogne, Paris, where the different products of electric street-lamp manufacturers can be tested under actual working conditions.

An Electric House

Twelve months' experience has proved the cost to be less and the service better than the most sanguine estimates

By F. ROSTRON

THE all-electric house dealt with in this article is of the familiar post-war semi-detached type having a hall, dining room, sitting room, scullery, three bedrooms and bathroom, and the results obtained should, therefore, be of interest to those who have been deterred from making the fullest possible use of electricity in their homes on account of the lack of reliable data concerning the cost of its application under such conditions.

Wiring of Building

The purchase price of the house included wiring for lighting from one point in each room with single control and a two-way controlled light on the stairs landing. For an extra price of £13 the following additions were made during erection of the house, the whole of the wiring being in screwed conduit:—

(1) Two-way control of bedroom lights.
(2) Additional hall light to supplement light on landing.
(3) A power plug in each bedroom, each downstairs room, and the scullery, and an additional plug in the dining room near the dining table.
(4) Installation (only) of cooker control switch and cooker.
(5) Installation (only) of 20-gallon water heater.
(6) Installation (only) of five sub-circuit meters.
(7) Installation (only) of bell transformer.

To give as much flexibility as possible without increasing unduly the expense of extra wiring, "Santon" power plugs were used throughout. As each plug of this make has its own self-contained fuse, the principal objection to feeding more than one consuming device from one point is avoided, since each sub-circuit is protected individually and therefore does not rely solely on the larger main fuses for protection. The plugs and sockets used are of unusually solid construction, both internally and externally, easy to operate, and rapid in make and break. A separate earthing terminal is provided and the internal arrangement, particularly of the large plugs, has been given such careful consideration that it is a real pleasure to wire them.

Electrical Equipment Installed

The house is occupied by a family of three (two adults and a young baby), regular use being made of the following equipment, which was considered the minimum required:—20-gallon water heater, 2-kW wash boiler, cooker, two 2½-kW and one 750-watt fires, 3-valve all-mains wireless receiver, coffee percolator, two kettles, toaster, iron, two table lamps. The addition of a vacuum cleaner and a refrigerator in the near future is contemplated.

Energy at 400/230 volts, 40 cycles, is supplied by the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, all three-phases and the neutral being brought into the house to enable the load to be distributed as evenly as possible.

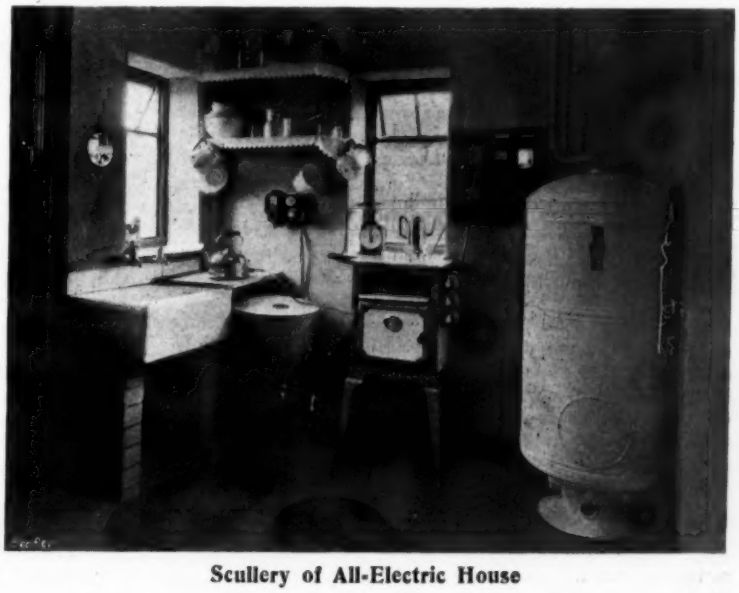
During the twelve months' period under review there has only been one failure of supply, which occurred at 10.45 p.m. on September 18th, and, as the supply was resumed during the night, little inconvenience was caused.

Advantage is taken of the "rateable-value" system of charging offered by the supply authority, under which there is a fixed charge of 12s. 9d. per quarter and a running charge of 1d. per kWh for the first 120 kWh in every quarter and ½d. per kWh in excess. As the 120 kWh are exceeded in every quarter, it is more convenient to include the extra ½d. per kWh for the first 120 kWh in the fixed charge, when the basis becomes a fixed quarterly charge of 17s. 9d. with a kWh charge of ½d. for energy for all purposes. To this must be added the meter rent of 1s. per meter, which amounts to 3s. per quarter as the supply authority has standardised the use of three single-phase meters for four-wire services. This raises the fixed charge to £1 0s. 9d. per quarter. In spite of this disappointing addition of meter rent, the tariff is attractive and shows considerable enterprise on the part of the undertaking, as the house is in a sparsely populated neighbourhood at the foot of the Yorkshire moors, which rise sharply to 1,500 feet above sea level immediately behind the house.

Operating Costs

Month.	Heating.	Lighting.	Cooking.	Water-heating.	Wash-boiler.	Total.
January ...	818	42	115	311	8	1,294
February ...	629	31	94	283	13	1,050
March ...	544	20	87	265	22	938
April ...	465	11	96	257	14	843
May	313	7	92	265	20	697
June ...	57	3	59	255	20	394
July ...	42	5	79	268	19	413
August ...	55	7	92	272	7	433
September	141	9	91	273	20	534
October ...	258	22	91	281	21	673
*November	186	13	26	90	4	319
December	719	57	121	292	29	1,218
kWh per ann.	4,227	227	1,043	3,112	197	8,806
Ann. cost	£10 16	11/7	£2 13 3	£7 19	10/1	£22 9 11

For the moderate figure given, an unequalled service is obtained without any expenditure on coal, matches, or fire-lighters; without dirt, noise or smell; and without the necessity for the expense and worry of a domestic servant.



Scullery of All-Electric House

Separate meters are installed on the heating, lighting, cooking, water-heating, and wash-boiler circuits, and these are read each month. In the above table an analysis is given of the consumption over a period of twelve months. The fixed charge works out at 0.113d. per kWh, which, added to the running charge, makes the overall average price of 0.613d. per kWh.

* House closed for three weeks except for occasional short-time heating.

The Lighting Installation

The customary ceiling plate, from which hangs a length of flex terminating in a lamp holder with shade carrier ring, was fitted at each lighting point, but in the scullery, dining room, and sitting room these were scrapped, and totally enclosed fittings with 150-watt lamps mounted direct on a ceiling hook or plate were substituted; a white paper was chosen for the ceiling. As a result, there is adequate illumination, evenly distributed, with no shadows except the slight and unavoidable shadow caused by the chimney breast. This type of lighting is particularly useful in the scullery, as it gives as good illumination on all the shelves and in the cupboards as on the table, and prevents the possibility of the operator's shadow being thrown on the work in hand, whether working at the table, cooker, cupboard, wash boiler, or sink; the results obtained have been so satisfactory that it is intended to convert the remaining lighting fittings to the small ceiling pattern in the near future. The table lamps are used when local lighting only is required or to provide a soft, warm light to accompany an evening's radio entertainment. For the dining table a " daylight " lamp is fitted, with a resultant increase in whiteness of table linen and sparkle of cutlery, glassware, and silver which surprises even those who expect an improvement over the standard lamp. The hall light is switched on at dusk and extinguished only on retiring.

Arrangements for Room Heating

For heating, a Ferranti radiant-heat fire is used in the dining room and the sitting room. This consists of a large truly parabolic reflector, chromium-plated and fitted with two " Globar " elements, each of 1¼-kW loading. The rear bar is controlled by the plug, the front bar being switched on and off by a foot switch. Experience with these fires has fully justified their choice. As a result of a daily cleaning with a damp wash leather, followed by a polish with a dry soft cloth, the plating is in at least as good a condition as when it left the works and, as the dimensions of the elements enable them to approach as nearly as possible the focal centre of the parabolic reflector, it provides an immense yield of radiant heat. It is unnecessary to delay entering a room until the temperature of the air has been heated to a comfortable value by convection, as the high radiation efficiency of the fires gives the individual the immediate benefit of the heat. Except in the very coldest weather, for example, it is customary not to switch on the fire in another room until a very few minutes before it is to be occupied and these few minutes are only required to remove the chill from the furniture. With the exception of two occasions when snow was driving in the wind, it has been found comfortably warm to have one window just caught open and the fire on, thus giving the occupants of the room the advantage of radiant heat, coupled with the benefit of breathing clear, pure air. After twelve months' constant use, the bars still appear capable of many months' more service, one bar still giving quite sufficient heat for most occasions, with an occasional boost from the second bar. The bedroom fire (750 watt) is a smaller model having one bar only—a wire-wound element embedded in cement.

The economy of the radiant-heat type of fire is evidenced by an average weekly cost of only 4s. 2d.

Thermal Storage Water Heating

The thermal-storage system of water heating was adopted as being the most economically satisfactory method. As no special tariff for night heating was available it was decided that a Ferranti 20-gallon unit would be adequate. As is shown in the illustration, the heater is installed in the scullery; the sink is the most frequent draw-off point and therefore allows for the shortest pipe length to minimise loss by pipe radiation. The first cost of the installation was reduced by obtaining an allowance from the builder for the omission of the fire-back boiler, the copper cylinder, and the customary pipework between those two fixtures.

The water container is of copper and the lagging material between it and the outer cylinder is granulated cork, giving excellent heat insulation. The makers claim that, if hot water is not drawn off, it costs less than 1d. for 24 hours to maintain the water at the required temperature The element is of 1½-kW loading, and a thermometer and adjustable thermostat are provided. Hot water is drawn from the top of the cylinder and cold water enters at the bottom against a baffle which prevents the cold water mixing with the hot; the result is that, if the current is switched off for any reason, the last gallon of the 20 is almost at the same temperature as the first. The thermostat is set at 195 deg. F. and is constantly in circuit. Since the heater was installed it has not required attention of any kind and has supplied all the hot water required for the household, except that used for culinary purposes. The average daily demand on the installation is for two baths, for washing up after three meals, for other general purposes, and, on two days per week, for the filling of the wash boiler. At 0.613d. per unit the average daily cost for 12 months' running is 5.23d.—not an exorbitant figure for a regular service of water, hot enough for shaving and too hot to permit waste by handwashing under the tap.

Cooking by Electricity

As the domestic appliance side of the supply undertaking was not developed when the house was taken over, it was necessary to purchase a cooker, and it was decided to buy the " Creda Junior " model, which has an 8-in. by 8-in. 1.8-kW hot plate, a 1.5-kW grill, and 1.25-kW oven, the inside dimensions of which are 12 in. wide by 9¾ in. high by 9½ in. deep. Unfortunately the inside projection of the heat indicator, which is located in the middle of the oven door, reduces slightly the available depth of oven. This cooker is advertised as being for 2-4 persons, and it certainly is capable of all that is claimed for it; on occasion it has been used to cook a 4-course dinner for seven persons; a little organisation and forethought has been necessary, but there has been no waiting. The hot-plate is of the enclosed pattern and, used in conjunction with pans with accurately machined bottoms specially designed for the purpose, it has been found to be satisfactorily fast. An ironclad control switch was purchased with separate kettle plug. The first time this plug was used, the split ring came away in the user's hand and, in spite of many attempts, a smooth plug fit has never been obtained, with the result that the circuit to the kettle is now broken by the main switch and the kettle disconnected by the female plug at the kettle end of the lead. The use of an inter-connected switch plug suggests itself for this purpose instead of the simple plug fitted as standard. It is unfortunate that the main switch, kettle outlet, and pilot light are not all fitted as standard to the leading makes of cookers, thus making the cooker self-contained. Such an arrangement was illustrated in the ELECTRICAL REVIEW of October 17th, 1930 (fig. 15, page 648) and, unless there are reasons to the contrary not detectable in an illustration, it ought to command a ready sale, if only because it is self-contained.

In connection with the weekly cooking cost of 1s. included in the table, it is necessary to mention that, frequently, cooked meals, except breakfast, are only required for one person and, consequently, the electricity consumption for cooking is below that of an average household of three persons, except where lunch and dinner " out " are the rule.

Toasters, Percolators, and Sundry Appliances

Among the smaller consuming devices the electric iron and the coffee percolator are by far the most useful. Both are in regular service, the percolator twice and sometimes three times per day. Recently the glass top broke in normal service and it was suggested to the manufacturers that it would probably be advantageous to make it of " Pyrex " or some similar material. The suggestion was most courteously received and the makers have promised to communicate their decision when they have investigated the idea thoroughly.

The electric toaster is rarely used, as it has been found that the grill of the cooker makes excellent toast and has the advantage of enabling the whole of the cooking for a meal to be done at one point.

Alignment Charts

Their Application to Problems of Power-factor Improvement

By W. A. BARCLAY, M.A.

THE advantages presented by the use of alignment charts in the rapid solution of problems not requiring a high order of accuracy are now becoming universally recognised by engineers. Such charts are especially useful when it is desired to arrive quickly at an estimate which in the ordinary way would entail considerable calculation. The degree of approximation is comparable with that afforded by a slide-rule, and, indeed, the alignment chart may be regarded as an extension of the slide-rule principle to a plane space of two dimensions. The method of use is extremely simple. By placing a straight line between the known values of two of the variables on their respective scales, the unknown value of the third or dependent variable is found where the index line crosses the corresponding scale.

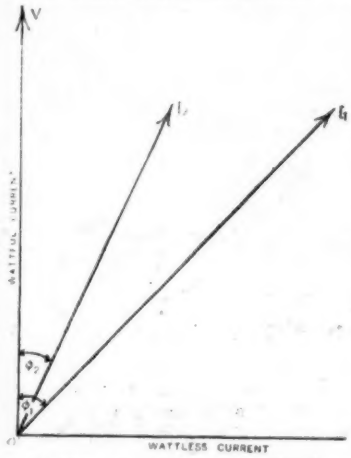


Fig. 1.—Vector Diagram for P.F. Improvement.

The alignment charts which accompany this article are designed to illustrate two very common problems in power-factor improvement. As is well known, the power factor of a single-phase a.c. circuit containing a motor or other inductive load can normally be improved by placing a condenser across the supply. The conventional diagram in fig. 1, in which ov represents the voltage vector, and oi_1 and oi_2 the current vectors before and after the installation of the condenser, is too familiar to require detailed explanation. It may be remarked, however, that as the shunting capacity is increased, the power factor of the load is increased from cos ϕ_1 to unity.

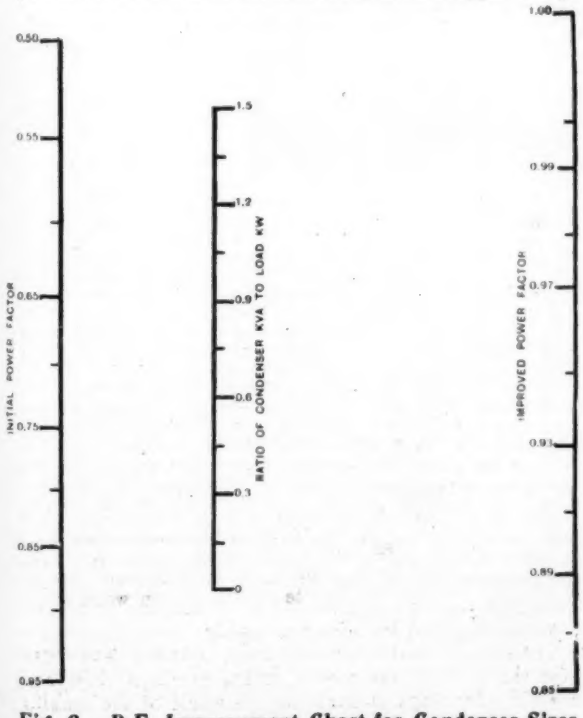


Fig. 2.—P.F. Improvement Chart for Condenser Sizes

Since the condenser itself takes a certain amount of wattless current, we may express its value in terms of the kVA taken by it. The chart in fig. 2 is designed to show the ratio condenser kVA/load kW, necessary in order to improve any existing power factor cos ϕ_1 to any desired value cos ϕ_2. As an example, suppose an a.c. circuit has a normal load of 20 kW at a power factor of 0.75. Let it be required to find the size of condenser necessary to raise the power factor to 0.95. By joining 0.75 to 0.95 on the outer scales of the chart it will be found that the index or reading line passes through the value 0.55 on the inner scale. The condenser kVA necessary will therefore have 20 times this value, or 11 kVA.

The second chart, fig. 3, is designed to assist the prospective user of such condensers to form an idea of the percentage saving in total kVA to be expected from the installation. In many cases the supply company charges on a two-part tariff based on a fixed charge per annum per kVA of maximum demand, with the addition of a

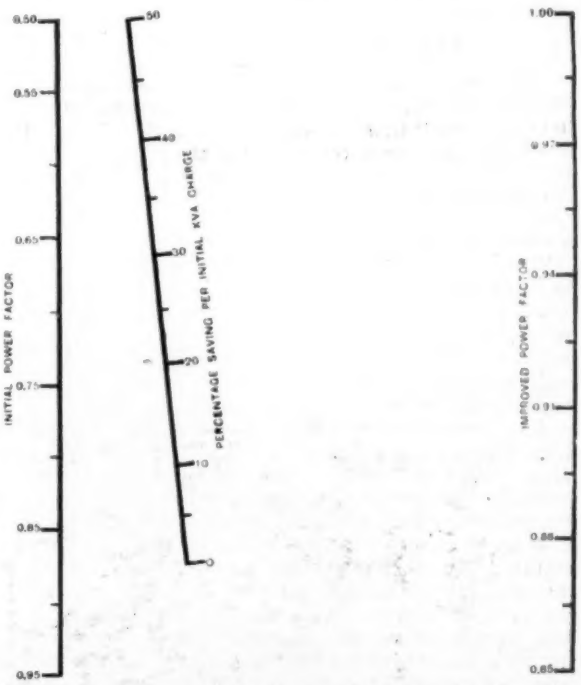


Fig. 3.—P.F. Improvement Chart for Percentage Savings

small fixed charge per kWh. In such cases the reduction in the fixed annual charge will depend on the reduction in the kVA taken from the supply. The manner of use of this chart is the same as for the previous example: a line joining the values of initial and improved power factors will meet the third scale in the required percentage of saving in the supply kVA. For example, using the same numerical values as were taken in the previous example, the improvement of power factor from 0.75 to 0.95 results in a percentage saving in kVA of 21 per cent. That component of the charge which is proportional to kVA of maximum demand will, therefore, be reduced in this ratio.

Since any straight line placed across either diagram meets all the scales in corresponding values, we may use the diagrams inversely; if a saving of 35 per cent. on the existing kVA supply is desired, the existing power factor being 0.63, it will be found from fig. 3 that a power factor of 0.97 is required; hence, using the chart in fig. 2, by joining 0.63 to 0.97, we find that the ratio of condenser kVA to load kW must be 0.98.

Transmission-line Masts

Little agricultural interference and small weight and cost of erection are among the advantages afforded by the "Yorkshire" Narrow-base Pole

As the principal stresses to be withstood by the supports of an overhead line are those due to the weight of the conductors and sleet and the wind pressure on them, it follows that the design for standard spans and loadings will only vary with the height of the mast, which depends on the nature of the country to be crossed. This being so a considerable measure of standardisation of design can be attained, and with it an appreciable reduction in first cost.

The standard structure designed for the minimum height required is supplemented by standard extensions which can be added at the base when greater heights are necessary. This method of construction reduces the need for special structures to a minimum, and enables masts to be constructed and stocked in advance of the actual field work, with the assurance that if unforeseen difficulties arise during the erection of the line, the height or position of a mast can be changed at a minimum cost and without delay. An extension of this principle has led to the construction of the standard masts in parts to facilitate transport and handling in the field.

It has been found that the broad-base lattice tower is, in many cases, a serious obstruction to the occupier of the land, that the maintenance of the large surface of steelwork is expensive and inconvenient, and, moreover, that the members of the structure have to be substantially heavier than actually necessary in the first instance, so as to allow for inevitable weakening by corrosion. As a result of these considerations the design of the narrow-base mast has received closer attention, and it now seems clear that in the majority of cases it presents advantages over the wide-base tower. These considerations have led to a design of mast now widely adopted by the Yorkshire Electric Power Company in which, not only is the base of the mast narrow, but the mast itself is built up of standard rolled bars and sheets to a solid "H" section which presents a minimum of surface and a substantial thickness of metal to resist corrosion. The general design of these "Yorkshire" masts is depicted below, which picture is typical of the company's 66,000-volt construction. The standard angle and intermedite masts differ only in the top sections, which are interchangeable. The masts are constructed in standard lengths arranged to be riveted or bolted together on the field. Assembly in the field is a simple matter, and the time and cost of erection has been reduced to a minimum. By careful design the total number of standard parts required for any line, including those for both angle and intermediate masts, has been reduced to eight. Similar consideration has been given to the design and construction of the foundations, and standard designs have been developed to meet the varying requirements of line loading and foundation resistance through all gradations of soil from rock to swampy ground.

A 66,000-V Line, showing Construction of "Yorkshire" Mast

The advantages claimed for the design are briefly as follows: the cost to weight ratio is lower than in other fabricated structures; this result is obtained by the economical use of standard bars and plates, and by proportioning the modulus of section to the stresses along and across the line, respectively. Transport costs are reduced to a minimum by the convenient lengths and weights adopted, and the standard parts save delays in erection and permit of alterations to meet unexpected difficulties or objections to the position of any mast. The cost of delays in line construction by ordinary methods on this score is no inconsiderable part of the total. Under extreme conditions, such as irregular sleet loading or broken wires, the torsional flexibility of the mast relieves unbalanced stresses and prevents failure by collapse, a weakness to which the wide lattice tower is by its design most subject. The space occupied by the base of the "Yorkshire" mast is approximately 2.4 sq. ft., or about one-hundredth of the area occupied by the intermediate lattice masts of the Central Electricity Board; the small interference with agricultural operations in the former case is indicated above, which illustration is reproduced from a photograph taken from the top of a mast erected in arable land. The importance of an unobtrusive appearance has been brought home to all engineers by recent widespread objections to the erection of large lattice masts in various parts of England.

Small Agricultural Interference Around Mast Base

Among recent lines for which this type of mast has been used by the Power Company is a 66,000-volt ring main of approximately 92 miles in length interconnecting the company's generation stations with main distribution centres in South Yorkshire.

Galvanising Furnaces.

Heat radiation, which comprises 60 per cent. of the losses from electric galvanising pots, may be reduced by approximately 60 per cent. and the efficiency of the galvanising furnaces increased from 14 to 50 per cent. by providing the proper insulating material around the sides, bottom, and top of the kettle.

Tests are reported in the *Electrical World* on an electric galvanising furnace which had a kettle 10 ft. 10 in. by 40 in. by 49 in., and a metal surface area of 36 sq. ft. This galvanising kettle was set on a foundation composed of 1 ft. of concrete, on top of which was a layer of heat insulating brick 2½ in. thick. On top of this there was a layer of fire brick 2½ in. thick and alternate 5-in. piers of fire brick and heat insulating brick. The kettle was insulated with the special brick of 5 in. thickness on the sides and three layers of the brick on the ends. One flat layer of ordinary red brick was also placed all around the kettle. More than half the radiation losses take place at the surface of the metal.

When the test was started the pot held 4,400 lb. of lead and 37,800 lb. of zinc, or a total charge of nearly 20 tons. The zinc was melted in 28 hours with an energy consumption of 2,940 kWh. Each kWh melted 14.3 lb. of metal.

Tests for productive capacity showed that when 0.845 tons per hour were put through the bath it would not lose temperature. The average power used for operating at this rate was 103 kWh, and the average power required when the kettle was idle without a cover was 48 kWh at a temperature of 820 deg. F. A test made at 875 deg. F., which is the galvanising temperature, showed that 53.3 kWh was required with the kettle idle. During this test the kettle showed an operating efficiency of **48.2 per cent.**

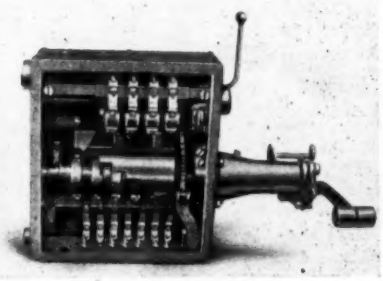
Electric galvanising has many inherent advantages, which may be summarised briefly as follows: Uniform temperature control, resulting in reduction of dross; uniform and economical zinc coating; increase of pot life due to elimination of hot spots; and better quality with less rejects; less attendance required.

A New Electric Trolley 'Bus

An Unusual Railless Vehicle with the Driving Motor Located at the Front End of the Chassis

DEMONSTRATION runs have recently been given in different parts of the country with a new six-wheel trolley omnibus which is known as Model 663T, the joint production of the English Electric Co., Ltd., and the Associated Equipment Co., Ltd., the first-named concern being responsible for the driving and control equipment and the bodywork, and the other for the chassis. The most distinctive feature of the new design is the location of the electric motor at the front end of the chassis, which is shown below, so that practically the whole of the electrical equipment is centralised in, or close to, the driver's cab and is rendered accessible by the provision of a front louvred panel as indicated by the first of the accompanying illustrations.

Removable Front Bonnet Panel



Master Controller and Reverser

In the design of the control arrangement the object has been to reduce the number of operations which the driver has to perform. As now fitted, all power and brake applications are effected by the use of two pedals and a handbrake lever, which has been achieved by the use of solenoid-operated contactors designed to meet the special conditions of railless road traction. The essential parts of the control equipment are a master switch, a reverser, a contact panel, current-limiting relay, and brake switch. The master switch, shown above, which is located at the extreme front of the chassis, controls the operation of the contactors and ensures that they open and close in the correct sequence. It is a drum-type switch of robust design operated by a pedal and lever so proportioned that the effort required is quite small and compares favourably with that necessary in the case of the accelerator of a petrol-driven vehicle. As the current carried by the master switch contacts is quite small, the arc at breaking circuit is negligible; since, moreover, the contact fingers are substantial, adjustable, and provided with renewable tips, maintenance is a simple matter. In the case of a single-motor trolley 'bus the master switch has six notches, of which one can be used for field shunting, if desired; while in the case of twin-armature motor equipment there are eight switches, either four series and four parallel, or four series, three parallel, and one field shunt, according to requirements.

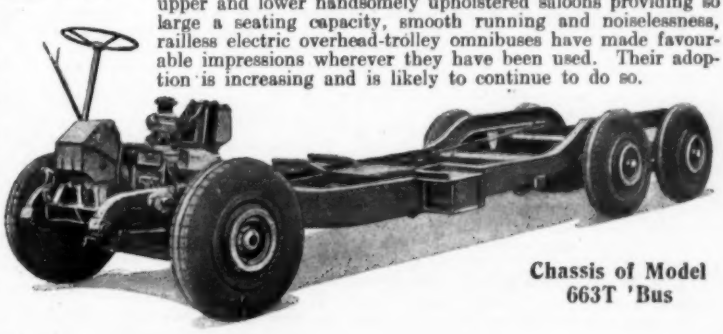
Mounted in the same case as the master switch and interlocked with it is the reverser, the latter being so arranged that it can only be moved when the master switch is in the "off" position. The reverser is hand-operated and cannot be moved from one position to the other while power is being supplied to the motor. The bank contactors is mounted in a compact asbestos-lined steel case having a removable cover, and each unit has its own blow-out device with a removable arc chute made of a special grade of heat-resisting material. The contactors are built up of interchangeable parts and have removable contact tips and auxiliary fingers. In the same case as the contactor group there is a current-limiting relay, the purpose of which is to regulate the acceleration automatically. The first and second notches of the master switch are completely under the control of the driver, but when the master switch is moved to the further notches the operation of the corresponding contactors is controlled by the relay, which is set to the particular value of current desired. After the driver has reached the second notch he can depress the master-switch pedal to its full limit without any harmful effect on the electrical equipment. On the last field notch the setting of the relay is adjusted automatically, by the bringing into circuit of an auxiliary coil, an adjustment necessary with field shunting owing to the growth of the current which takes place when moving from full-field to shunt-field conditions.

The control equipment outlined above can be extended if desired to include rheostatic braking. The only additional apparatus is a brake switch, operated from the same brake pedal that is used to bring the air brakes into action. The arrangement is such that the initial depression of the pedal operates the brake switch and applies rheostatic braking, while further downward movement applies the air brake while still retaining rheostatic braking. Electric braking acts through the transmission, as it is considered unwise to put undue strain on this vital part of the chassis. "English Electric" rheostatic braking has been so graded that it acts in a similar manner to that provided by a petrol engine, which, when in gear, gives adequate braking for coasting purposes without any harmful effects on the cardan shaft, universal joint, or differential gears. Furthermore, by employing this type of electric brake, the life of the ordinary brake liners is materially lengthened, as they are not used by the electric braking and are only brought into action when the vehicle has to be stopped, their application then taking place at a comparatively low speed. The electric brake is usually provided with two notch positions, so graduated that retardation is well within the limit of passenger comfort. With a trolley-'bus which weighs when fully loaded, say, twelve tons, the efficiency of the rheostatic braking system is stated to be such as to permit coasting down a grade of one in eighteen at a speed of from 10 to 12 m.p.h. on the second brake notch. The first brake notch permits a coasting speed of approximately fifteen m.p.h. Another important point to which attention may be drawn is the interlocking of the rheostatic brake with the main control in such a way that the power is cut off when the brake is applied, so that it is impossible for driving power and braking action to be applied at the same time.

A New Electric Trolley Omnibus

On the mechanical side there are no departures from the current practices of the two companies; triple braking is fitted, and a third differential is interposed between the drives to the two back axles.

With their pleasing body appearance, enclosed driver's cab, upper and lower handsomely upholstered saloons providing so large a seating capacity, smooth running and noiselessness, railless electric overhead-trolley omnibuses have made favourable impressions wherever they have been used. Their adoption is increasing and is likely to continue to do so.



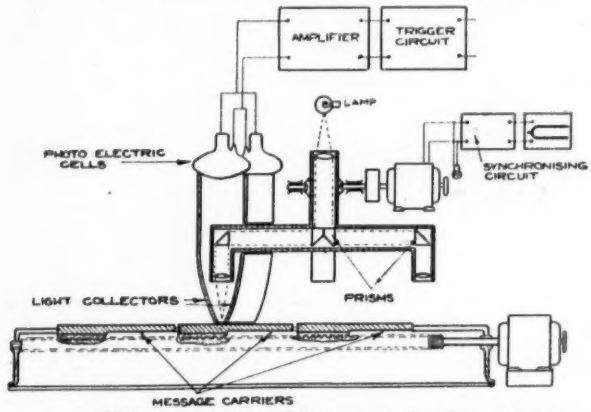
Chassis of Model 663T 'Bus

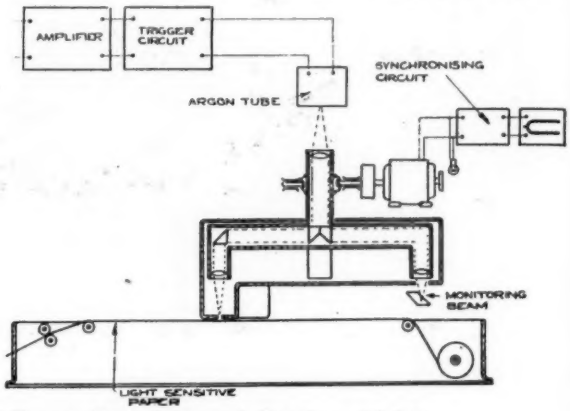
Facsimile Photo-telegraphy

A high-speed system, which employs a rotary scanning device, has been developed for transmission at a rate equivalent to 180,000 words per hour, it thus being some six times faster than systems hitherto available

THE number of systems already available and in use is indicative of the importance that is now attached to facsimile photo-telegraphy. In devising such systems the foremost aim has always been a high degree of accuracy of reproduction of the tone values of pictures. It is generally known, however, that commercial telephony is possible over circuits much inferior in quality to those needed for relaying music which is to be radio-broadcast, fair intelligibility suffic-

Broadly, the transmitter (figs. 1 and 3) consists of an optical device for scanning the message in a series of fine parallel lines with a point of intense light; the light reflected from each elemental area of the message is collected in to a photo-electric cell which delivers to an amplifier a signal corresponding in amplitude to the tone value of the picture element, pure white giving a large signal and pure black a zero signal. In most systems the beam of light used for scanning is chopped



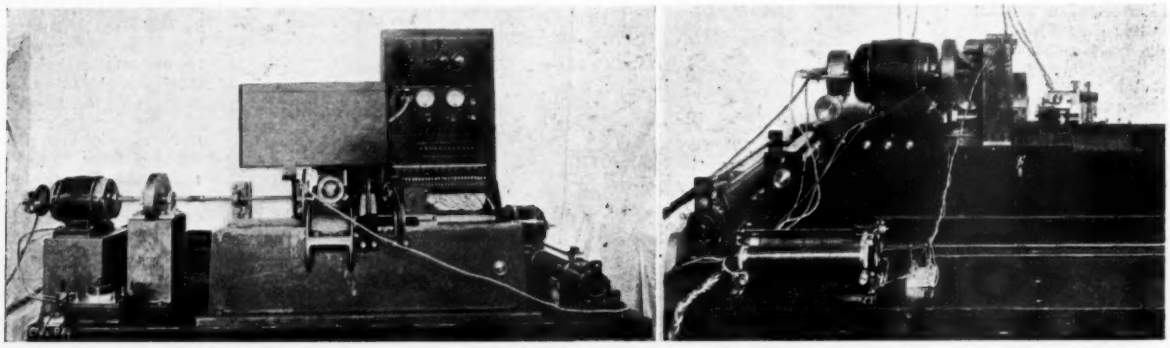


Figs. 1 and 2.—Diagrammatic Arrangement of Transmitter (left) and Receiver (right)

ing in the former case, whereas close fidelity is necessary in the latter.

Similarly, the facsimile photo-telegraph system demonstrated last week at Hendon by the International Telephone and Telegraph Laboratories (Inc.) makes no attempt at tone definition. It has been expressly designed to provide a service that can be furnished both cheaply and reliably for the transmission over long distances of black-on-white line diagrams and printed and typewritten documents between the light and dark portions of which there is sufficient contrast to "trigger" an electrical circuit, and thus convey the meaning of the message rather than define the exact shapes of the characters

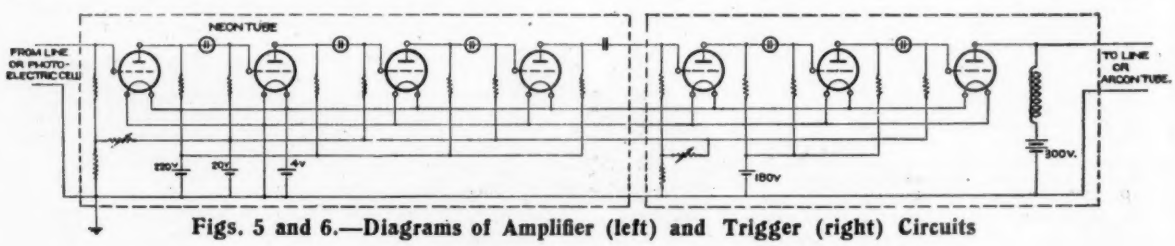
up by a slotted disk, otherwise a long signal of constant amplitude would not pass through ordinary amplifying devices. In the present system the speed of scanning is very high and even when a blank sheet is being scanned a signal (which is used for phase compensation) is transmitted at least 10 times per second; thus all means of light modulation previous to the scanning can be dispensed with, provided an amplifier capable of passing down to 10 cycles per second is available. The message is carried on a plane carrier which is moved along in a horizontal direction through the apparatus. The scanning beam has a circular motion, the plane of the circle being parallel to that of the message, imparted by a rotating shaft



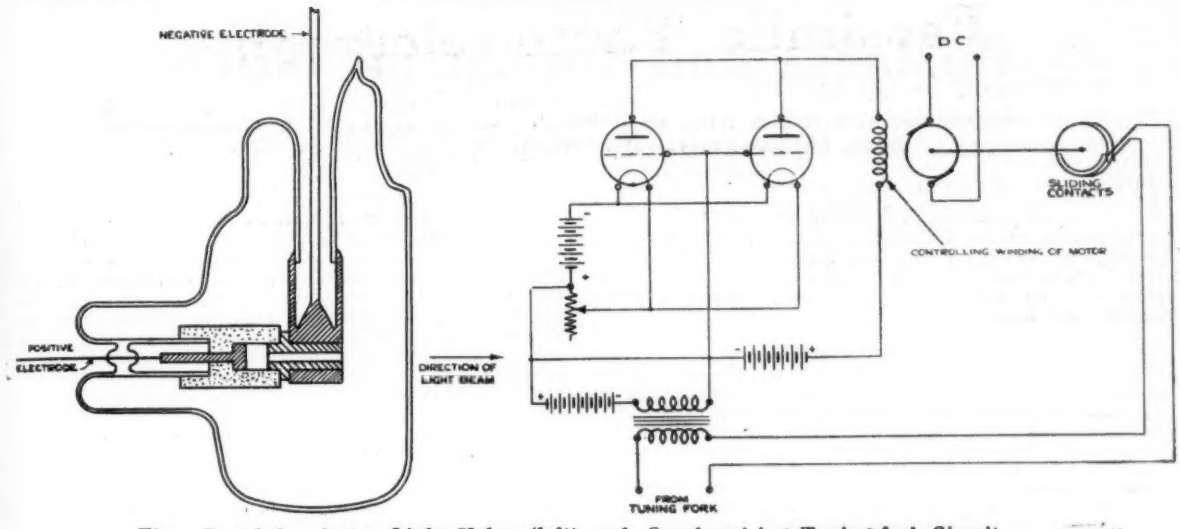
Figs. 3 and 4.—Experimental Transmitter (left) and Receiver (right) at the Hendon Laboratories.

of which it is composed. This limitation of the system is justifiable if the results are judged by standards of intelligibility and speed. Thus the present experimental apparatus will transmit 60 pages per hour, each page containing 500 typewritten words, or up to 1,500 printed words. Moreover, transmission is continuous, sheet succeeding sheet without the necessity for performing any operation after each page has been transmitted. The production models are expected to work at a speed equivalent to 180,000 words per hour, which is some six times faster than other known methods now in use.

whose axis is at right angles to the plane of the message, which bears a system of four prisms 90 degrees apart and receives light in a parallel beam along its axis. To each prism is attached a tube ending in a further prism, which throws the beam down at right angles to the plane of the message. A suitable combination of lenses focuses the light beam on the message. Each beam in turn, therefore, scans the message in a circular arc and is immediately succeeded by the next beam, &c., each turn of the shaft thus scanning four parallel circular arcs. The light reflected by the message is caught



Figs. 5 and 6.—Diagrams of Amplifier (left) and Trigger (right) Circuits



Figs. 7 and 8.—Argon Light Valve (left) and Synchronising Tuning-fork Circuit

by a pair of mirrors connected to the amplifier. As the scanning point moves from one edge of the message to the other the light collected from equally illuminated areas is not constant. The method of correcting for this is described later. Meanwhile the message holder is moved lengthwise, driven by a worm screw, and any holder can be added or removed at any time. This method saves a great deal of time, since the messages can be placed in the holder when off the machine and engaged with the worm screw while the preceding holder is still passing through the machine. If the message is carried on a cylinder, the machine has to be stopped at the end of the transmission of each complete page or picture and a fresh message attached, involving a delay of from 3 to 5 minutes, whereas the present system is continuous.

At the receiver (figs. 2 and 4) a similar device is used, the mirrors for collecting light as well as the photo-cell being obviously unnecessary. A strip of photographic paper moves continuously forward at a speed equal to that of the message at the transmitting end, and the beam of light is obtained from a light valve modulated by the incoming signals. This valve is an argon lamp (fig. 7) and gives a very concentrated glow inside a small tube (1 mm. diameter). The image of the glow is projected on to the paper by the same lens and prism combination. Its intensity is controlled by the incoming signals and its spectrum varies so that for large signals it is not only brighter, but also more actinic than for weak signals.

The signals are of course amplified before they are applied to the transmitting channel. The omission of the chopping disk is made up for by a special amplifier, each stage of which comprises a vacuum tube and a neon tube (fig. 5); the latter acts to some extent as an amplifier and also renders unnecessary the use of polarising voltages and the super-position of plate voltages. To help to overcome transmission difficulties which may arise when radio channels are used the signals are translated into impulses of constant amplitude and variable duration. Every one is changed into a rectangular signal furnished at a local source. Thus a difference of 50 per cent. more between signals does not affect the transmission, they being equalised automatically before they leave the transmitting station. Noises, atmospherics, and echoes can be minimised to a large extent and a clean message received, even on noisy circuits. Such a transformation is accomplished by means of a trigger circuit (fig. 6) which operates only at a certain well defined level, and whose operation is based on the properties of neon tubes that act in this case as relays, operated by the signals, interrupting current from a local source.

It is of course necessary that strict synchronism be maintained between the two scanning arrangements, as well as a definite phase relation. At each station the speed of the motor moving the scanning head is controlled exactly by means of an electrically-driven tuning fork (fig. 8) that furnishes a wave which is applied to the grid of a vacuum tube. The wave is cut off during half of one period by sliding contacts on the motor shaft. When the motor runs at an exact speed multiple of the tuning-fork frequency, each wave is cut at its peak, and at its lowest point the mean voltage applied to the grid of the vacuum tube is thus zero. If, however, the motor speeds up or down the voltage takes a positive or negative value, thus changing the plate current, which is then superimposed on the excitation current of the motor, and thus acts to oppose the speeding up or down of the motor.

For putting in phase, a signal is given by two small lines at the edges of the mirrors, which give two points for every revolution. At the receiving station, opposite to the message, a cylindrical strip of celluloid is placed. While one lens sends the received signals to the photographic paper the two idle lenses receive the same signals and project them on to the celluloid strip, where they are seen and brought to their proper location by moving the sliding contacts around the shaft of the motor. Transmission is then ready to take place. If the two tuning forks are not exactly tuned, any displacement in phase is taken up as soon as it occurs by the same process, the picture signals being constantly under observation. Close synchronism is kept between the two tuning forks by means of a thermostat and a control arrangement acting on the driving magnets, allowing the speeding up of one tuning fork when it shows too great a lag with respect to the other.

Electric Furnaces for Precious Metals

A Successful American Example

A works in Attleboro, Mass., U.S.A., employs ten electric furnaces for melting, annealing, and tool hardening in connection with the various processes involved in the manufacture and heat treatment of gold and silver alloys and solders.

Melting is performed, according to the *Electrical World*, in a furnace rated at 22 kW, 110 volts, single-phase, 60 cycles. The elements are bar form, with water-cooled terminals, the heat being automatically controlled. Eight elements are arranged in pairs on the top, bottom, and sides of the heating chamber. The material to be melted is placed in a carbon crucible and is manually stirred with a carbon stick. This furnace has a maximum melting capacity of 300 oz. of alloyed gold and silver per run and a minimum capacity of 5 oz. The average time per melt is about 25 minutes. The equipment has a temperature range of 1,000 to 2,500 deg. F., the temperature dropping at the beginning of each melt and building up to full value in about five minutes. The average energy consumption is about 130 kWh for a nine-hour day. Assuming eighteen average melts per day, the average consumption of energy is about 1 kWh per 41 oz. of alloy. The monthly cost of melting is made up of: electricity, at 2 cents per kilowatt-hour, $62; water for cooling terminals, 5,000 cu. ft., $9.50; heating elements, $47.60 per set of eight; replacement of terminal tips, $25 to $30; and repairs and maintenance, $10; total approximately $154.

There are seven electric annealing furnaces with a combined rating of 259 kW, one of the "muffle" type and the rest of "arch" construction. There are also two tool-hardening furnaces. The annealing furnaces are controlled by varying the supply voltage through reactance coils, which in the arch-type furnaces consist of one separate reactance for each set of three arches; each set of arches is controlled automatically. The temperature range is from 1,000 to 1,400 deg. F. The rate of production typical of a 32-kW furnace having inside dimensions of 8×24×48 in. with nine arches is about twenty annealings per day, with a maximum capacity of 600 oz. per charge, taking from 15 to 30 minutes per batch, depending on the material.

There is an interesting application of electric heat in the direct-annealing process, in which the current is made to pass directly through the material to be treated. The power for this process is taken from a separate single-phase, 500-volt feeder and is stepped down to voltages varying between 8 and 64. The average current in the secondary circuit consumed by the material in process is 600 to 700 amperes, producing a temperature of 1,000 to 1,300 deg. F. The material treated by direct annealing is usually in the form of a metal ribbon varying from 0.006×1.0 in. minimum to 0.125×4.0 in. maximum, having an average length of 25 ft. The average time for this process is from 2½ to 3 minutes, including handling. This method of annealing in the open has the advantages of eliminating a special furnace, saving man-power (*i.e.*, two men for three minutes, as against ten men for 30 minutes), and a definitely better quality of product. The process, with a first cost of $4,000, paid for itself in nine months as a result of the economies effected.

D

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Kye to Make Gasfilled Lamps

The British Electric Transformer Company, Ltd., announce in our advertisement pages to-day, that immediately after May 8th they will commence the manufacture of Kye gasfilled lamps, and that particulars of their prices will be available on or about April 18th.

E.D.A. Luncheons

The annual luncheon of the South Wales and Monmouthshire area of E.D.A. was held at Cardiff on March 25th, the chairmain, Mr. A. Nichols Moore, presiding over a representative gathering. Proposing the toast "The British Electrical Development Association," Alderman A. E. Gough (chairman, Cardiff Electricity Committee) said the Association had done much to educate the public in the advantages to be gained from the use of electricity. He hoped they would continue to develop on the same lines for the benefit, not only of the British public but also of British industry as a whole. Responding, Mr. A. C. Cramb (director of E.D.A.), referred to the prevailing condition of trade in South Wales, and said that such conditions had to be met with the old fighting spirit and the adoption of electrical methods was one way in which trade could be improved. By the development of the domestic load supply authorities could recompense themselves for the loss of business on their industrial load.

The toast of "The South Wales and Monmouthshire E.D.A Area" was submitted by Mr. C. W. Sully who referred to the valuable results which had attended the de-centralisation of the Association's work.

In reply, Mr. A. Nichols Moore said there were some 49 electricity suppliers in the area, but, unfortunately, the support given to E.D.A. was not so strong as it should be. There were 36 authorities not subscribing financially. In conclusion he wished to refer to the excellent work done by the members of the area, and also to the invaluable assistance rendered by the area officer, Mr. E. J. Dowson.

There was a large and representative gathering at the Grosvenor Restaurant, Glasgow, on the same day on the occasion of the first annual luncheon of the east and west of Scotland areas. Lord Provost Kelly presided, and the principal guest was Mr. Frank Hodges of the Central Electricity Board. The Lord Provost, in introducing Mr. Hodges, congratulated the members on the mass of splendid work which they had already accomplished. Mr. Hodges proposed the toast "The British Electrical Development Association" and spoke of what had been done in Glasgow and the west of Scotland to popularise electricity. In many ways, electrical enterprise in the west of Scotland had been in advance of developments south of the Border. At the present time a successful effort had been made through stimulation of the domestic and commercial uses of electricity to make good the decline in industrial demand. Yet even if they were to develop much more rapidly domestically than they had done hitherto, that domestic advance would not of itself justify the existence of the grid. The progress that was possible with the domestic supply was not comparable with the progress that was possible industrially, provided the decline of Scottish industry was arrested and it took an upward trend. The stage had now been reached where it was possible for the Central Board to work out a tariff for the whole of Central Scotland, and negotiations with authorised undertakings in connection with that tariff were already far advanced. In conclusion he appealed to the gathering not to diminish their enthusiasm for extending the domestic supply and to take their share in the endeavour to re-establish Scotland in its old industrial superiority. The Electrical Development Association could contribute a great degree of co-operation, skill, and energy to the task.

Spanish Electrical Development

The Spanish journal *La Energia Electrica* recently published a review of electrical activities in Spain during 1930. In this it was stated that the most important flotation during the year was that of the S.A. Hidroeléctrica del Oeste de España. The capital is 40 million pesetas and the object is to harness the falls of the rivers Alagón, Tiétar, and Tajo. The potential output is estimated at 500,000 h.p. French bankers are stated to be financially interested in the concern. Under the title of Constructora de Maquinaria Eléctrica S.A., a company was formed with a capital of 12 million pesetas, with the object of constructing on a large scale generators, motors, transformers, &c. The concern relies on the co-operation of the Westinghouse Electric International Co. and the Société Matériel Electrique S.A. The Sociedad Española de Construcciones Electromecánicas, the Sociedad Española de Construcción Naval, and the Bank of Bilbao also participate in the new concern. In order to give greater impetus to the electrification plans in the Valencia district, the Cia de Luz y Fuerza de Levante has been formed with a capital of 30 million pesetas. This concern has absorbed various electrical companies in the district.

Electric Motors in Argentina

During the past year, says *Reuter's Trade Service* (Buenos Aires), there has been a marked increase in the amount of electric power used, it often replacing steam, oil, and gas. Consumption has shown an advance of 18.3 per cent. for power purposes, compared with 17.8 per cent. in 1929 and 12 per cent. in 1928. The market for small electric motors, ranging from ¼ h.p. (and even less) up to 3 h.p., is considered to be one of the best in the New World, sales exceeding $1,500,000 or about £300,000 annually. With the gradual extension of agricultural and pastoral interests and the establishment of many new industrial plants, good sales of electric motors may be hoped for in the future. In the Province of Mendoza alone the total power now consumed exceeds 25,000 h.p., divided among 1,400 motors. Arrangements have been made in several States to augment the sources of electric power, the present installed capacity of generating equipment being estimated at about 1,000,000 kW. Sugar plants are being operated more and more by electric motors, and textile factories and a number of sawmills and wood-working establishments (where the chief type of motor used is the squirrel-cage in sizes from 2 h.p. for the smaller band saws to about 20 h.p. for circular rip saws) have recently changed over from steam to electric power. A substantial part of the trade in small motors is in the hands of European manufacturers, whose prices are, roughly, 20 per cent. below American prices. Competition is keenest between British, Italian, and German makes. European representatives usually carry large stocks for immediate delivery, which accounts for their success as opposed to American dealers. Sixty per cent. of the sales represent a.c. motors, the rest consisting of d.c. motors, most of which are of the so-called general-purpose constant-speed type, there being but small inquiry for variable-speed motors; there is some demand, on the other hand, for adjustable-speed motors. A large proportion of imported motors are from 1 to 20 h.p., constant speed, with open frames. The chief railway and tramway workshops in Argentina are fitted with British motors; private sales are mainly in the direction of sizes above 1 h.p. of the a.c. class. Local regulations require that d.c. motors of ¼ h.p. or more shall be provided with starting rheostats. The cheapest form of starting switch is the only one selling regularly. There are no restrictions in force respecting safeguards for operatives, so that special devices of this kind are seldom asked for. Single-phase motors may be used up to 2 h.p., starting resistances being required with motors of ¼ h.p. and upwards. When d.c. motors exceed 3 h.p., a voltage of 440 is required. While smaller motors may be connected in to 220-V lines, squirrel-cage induction motors are allowed under certain restrictions.

German Radio Trade

According to the author of a recent article upon the German radio industry the gross annual output of that industry has a value of between 150 and 200 million Reichmarks. About 20 per cent. of the receiving sets and amplifiers produced in Germany are exported, but the proportion of the respective products differs. Some 30 per cent. of loud speakers and parts are exported, while the figure for radio spare parts is almost 50 per cent. of the total output. Compared with 1929 the value of radio exports in 1930 rose by 10 per cent., but the tendency to increase has declined heavily, mainly owing to falling prices; from 1928 to 1929 the corresponding figure was 40 per cent. Exports to important markets, such as Great Britain and Czecho-Slovakia, advanced, and especially those to Sweden and Switzerland. There was also a substantial addition in sales to markets such as France and Belgium, which previously had not been supplied to any great extent. Exports to Holland and Italy were smaller than in 1929. Trade was extended in Belgium, France and Czecho-Slovakia, particularly by means of licences for production. Imports of radio apparatus into Germany fell in value from 11.7 million Rmk. in 1929 to 10.8 million Rmk. in 1930, or about 8 per cent. The reduction was specially marked in imports from Holland, Great Britain and the United States.

Moroccan Electrical Imports

In the course of a report upon the economic situation in the French Zone of Morocco (published by the Department of Overseas Trade), the British Consul-General at Rabat suggests that there is scope for increased business by British manufacturers of several classes of goods, including engineers' supplies and mining machinery. He suggests that a combined sales organisation would prove of advantage. Statistics given in an appendix to the report show that in 1929 dynamos to the value of 4,470,000 fr. were imported into the territory as compared with 4,325 000 fr. in 1928. France supplied the bulk of these, Great Britain's share being valued at 171,000 fr. (against 13,000 fr.). France and Belgium were mainly responsible for the imports of insulated wire and cable which were valued at 6,035,000 fr. (against 3,887,000 fr. in 1928).

A Course for Women Demonstrators

The British Electrical Development Association, the Electric Lamp Manufacturers' Association, and the Electrical Association for Women have jointly arranged a three days' course, commencing on April 14th, for women demonstrators and showroom attendants. The proceedings will be inaugurated by Miss Haslett, C.B.E., director of the E.A.W. The following brief summary of the programme will indicate the very wide and varied scope of the course. On the first day Mr. A. C. Cramb, director of E.D.A., will speak on "The Electrical Industry and Woman's Place in It." He will be followed by Mr. W. J. Jones ("A Review of Modern Lighting Methods"); Mr. A. H. B. Elley ("Typical Lighting Fittings and Their Sales Possibilities"); Miss D. M. Noakes ("Furnishing the Home with Light"); Mr. R. O. Ackerley ("The Application of Colour Lighting in the Home"); and Mr. R. W. Maitland ("Architectural Lighting in the Home"). On April 15th Mr. R. W. Kennedy will speak on "Plug Points" and Mr. H. Bourne on "Domestic Appliances." In the afternoon a visit will be paid to the showrooms of the Westminster Electric Supply Corporation, where Miss A. Holm will address the delegates on "Electricity in the Domestic Subjects Centre," and Miss D. Vaughan will deal with "Quick Dishes on the Electric Cooker." This will be followed by a discussion, opened by Miss A. Waterman, on "Approach to the Consumer—The Mistress and the Cook." On the morning of April 16th Mr. A. C. Cramb will speak on "Electricity Tariffs, their Basis and Application," and Mr. J. I. Bernard on "Running Costs in the Electric Home." After luncheon, two electrical salesmanship demonstrations will be staged, covering hire-purchase and assisted-wiring schemes and good and bad lighting showroom service. On April 17th the E.A.W. annual luncheon and ball are to be held, and on the following day (Saturday) visits to showrooms and other places of electrical interest will be arranged. The Lighting Service Bureau can accommodate eighty visitors, and early application is recommended. The Electrical Development Association offers to reserve hotel accommodation for visitors.

Local Exhibition

Fenton.—The sixth and last series of the electrical exhibitions organised by the Stoke-on-Trent Electricity Department was recently held in the Fenton Town Hall. As in the preceding displays a number of the leading electrical manufacturers arranged stands and the result was a representative

Electrical Exhibition at Fenton

show of all kinds of domestic electrical appliances. Prominence was given to the Corporation's assisted-wiring and hire-purchase schemes by which the domestic load has been considerably augmented. A view of the exhibition is reproduced herewith.

Coventry Corporation and Contractors

Mr. W. J. Marston, the city electrical engineer of Coventry, speaking at the annual dinner of the local sub-branch of the Electrical Contractors' Association, said that in pursuing a policy of furthering the electrification of the home, he arrived at a contentious subject with which they had been mutually concerned for a long time—the subject of Corporation's electricity showrooms. The need for bringing about a better use of distributing mains was generally well recognised, with the result that it was now the exception to find a supply authority in any area which did not possess some sort of showroom. He felt confident that a showroom at Coventry could be run without unduly straining the harmonious relations which had existed between the Electricity Department and the electrical contractors, and at the same time be in the best interests of the public which they served.

Wages in the Engineering Industry

The joint investigating committee appointed by the Engineering and Allied Employers' Federation and the engineering trade unions held its first meeting in London on Wednesday last week. After a lengthy discussion on various phases of the situation in the engineering industry the meeting was adjourned. A conference of the trade unions concerned is to be held this month to consider the report which will be presented.

Bankruptcy Proceedings

W. C. Hannah, 2, Percy Street, Hull, electrical engineer.—This debtor appeared at the Guildhall, Hull, on March 23rd, for his public examination. His statement of affairs showed liabilities of £261 and net assets of £108. The debtor attributed his failure to the illness of his wife and himself, insufficient capital, &c. He said that he commenced business in 1919 with another at High Street. The partnership was dissolved in 1924, since when the debtor had carried on alone. The examination was closed.

W. A. Arzonie, trading as "Walter Arnold," 306d, North Road, Hull, wireless dealer, &c.—The first meeting of creditors herein was held on March 26th at the Official Receiver's office, 37, Scale Lane, Hull. The debtor's statement of affairs showed ranking liabilities of £74 and net assets of £6, leaving a deficiency of £68. The failure was attributed to "insufficient turnover." The case was left in the hands of the Official Receiver as trustee.

J. T. Lord, electrical engineer and contractor, Commercial Buildings, Oakworth, near Keighley.—Receiving order made March 20th on debtor's own petition.

J. G. Roger (Radio Wants), wireless engineer, Butter Market Chambers, Butter Market, Ipswich.—Trustee, Mr. C. L. Nankivell, 5, Arcade Street, Ipswich, appointed March 20th.

J. Tucker (Bristol Radiator Co.), wireless dealer, 30, Lower Ashley Road, Bristol.—Last day for receiving proofs for dividend, April 7th. Trustee, Mr. J. D. Turner, 26, Baldwin Street, Bristol, Official Receiver.

C. W. Sands, electrical and wireless contractor, High Street, King's Langley, Hertford.—Last day for receiving proofs for dividend, April 11th. Trustee, Mr. T. Gourlay, 29, Russell Square, W.C., Official Receiver.

Company Liquidations

Bel-Canto Radio, Ltd., Warple Way, W.3.—The statutory meeting of creditors was held on March 24th when Major Alexander, a director, presided and stated that the shareholders had nominated Mr. Andrews as liquidator of the company. The debenture holders had also appointed Mr. Andrews as receiver. According to a statement of affairs the liabilities amounted to £4,196, all due to unsecured creditors. The net assets were £585, leaving a deficiency of £3,611. The company was registered in June, 1926, and the issued capital was £8,289. Mr. Andrews said that when he was appointed a receiver for the debenture holders he advised all creditors not to press for the payment of their accounts. The debenture holders would then have been prepared to allow the business to continue and the directors were confident that they could pay their creditors in full. The receiver found that it would be impossible to carry on the business successfully unless additional capital were introduced, and voluntary liquidation was therefore decided upon. It was decided to confirm the appointment of Mr. Andrews as liquidator, with a committee of inspection consisting of the representatives of the Temple Advertising Agency, Kolster-Brandes, and Mr. W. A. J. Osborne representing creditors. The following are the principal creditors:—

	£		£
Carrington Mnfg. Co.	213	Swift Levick & Sons, Ltd.	225
Johnson, Weatherall, Sturt & Hardy ...	509	Taw Mnfg. Co., Ltd. ...	322
Kolster-Brandes, Ltd.	106	Temple Advertising Co.	527
Mullard Wireless Service Co., Ltd.	142	Wray, Ltd. ... ... Bankers	107 659

Kensal Radio Manufacturing Co., Ltd., 104-6, Chamberlayne Road, Kensal Rise, London.—The compulsory winding up order in this case was made on March 2nd upon the petition of creditors and the statutory first meetings of the creditors and shareholders were held last week at Carey Street, W.C. A statement was submitted showing total liabilities of £1,524; assets of £164, absorbed in the preferential and debenture claims; and a deficiency of £1,884 with regard to contributories, the issued capital being £525. The company was incorporated in November, 1930, to carry on business as radio and radio-gramophone manufacturers, and to act as agents. The trading resulted in a loss of £1,369. A debenture for £300 was issued in December last to secure a cash advance of that amount, and on February 7th, 1931, Mr. H. F. Smith was appointed receiver for the debenture holder. He sold the stock, fixtures, fittings and effects for £130, and handed that sum to the debenture holder. The failure of the company was attributed to the fact that too much time and money had been expended on experimental work, coupled with slow production which led to the cancellation of orders. Mr. A. C. Vincent (Vincent & Goodrich) was appointed liquidator.

Aeonic Radio, Ltd., radio manufacturers and dealers, lately trading at 90, Regent Street, W.—A meeting of creditors was held recently when Mr. T. Froude (Oscar Berry, Froude and Co.), 1, Queen Victoria Street, E.C., briefly outlined the history of the company and said that it went into voluntary liquidation last June, with a view to a scheme of reconstruction being carried out. Mr. O. Berry was appointed liquidator, and much of the difficulty which had been experienced in connection with the liquidation arose from the fact that no reservation

was made for royalties claimed by the Marconi Company. The company made an investment in a hire purchase concern, and in November, 1929, an overdraft of £10,000 was obtained from the bank on the security of a personal guarantee and an undertaking to issue a debenture, either to the bank or the guarantor as security. When the liquidation took place an agreement was entered into under which a new company should acquire the whole of the undertaking and property of the old concern and pay and discharge the whole of the existing debts, liabilities, and obligations. The shareholders of the old company could claim three shares of 2s. 6d. each in the new company, credited as to 2s. per share paid, in respect of every five shares of 2s. each held in Aeonic Radio, Ltd. Subsequent to the passing of the agreement for the reconstruction, a receiver was appointed on behalf of the debenture holder. The new company (Electrical & Radio Products, Ltd.) was formed during July of last year, the money subscribed to it being in the neighbourhood of £30,000. Last November the liquidator of the old company decided to cease trading, and the new company was given a tenancy of the new premises and factory at Horley, whilst certain stock and tools were handed over for payment which had been made to that date of approximately £8,000. With regard to the present position of Aeonic Radio, Ltd., the assets amounted to approximately £16,000, whilst there were unsecured creditors for £9,112, and other creditors not yet admitted totalling £6,937. In addition there was a contingent claim in respect of payments made on behalf of the old company amounting to £4,000, bringing up the liabilities to something like £20,000. Those figures did not take into account the contingent claim for damages by the Marconi Wireless Telegraph Co. A petition had been presented for the compulsory liquidation of the company.

After a protracted discussion, a resolution was passed to the effect that the voluntary liquidation should be continued, with Mr. Oscar Berry as liquidator, together with a committee of four of the creditors to act with three of the shareholders.

FRASER MARES, LTD., electrical engineers, 27, West Bute Street, Cardiff.—A meeting of creditors was held recently at Cardiff, when it was reported that the liabilities amounted to £1,447 and the assets to £121. In February, 1926, a debenture was issued for £500 in respect of cash advances to the company. The company was formed in February, 1926, with a nominal capital of £1,500, the subscribed capital being £1,080 all issued for cash. It took over an existing business and for the twelve months' trading to March, 1928, there was a net loss of £234. In the following year there was a loss of £422, and for the year to March, 1930, there was a profit of £199. A receiver had been appointed on March 9th last by the debenture holder, and the creditors decided to appoint Mr. F. E. Bendall, 35, Windsor Place, Cardiff, as liquidator of the company. Particulars of claims should be sent to Mr. Bendall by April 30th.

METROPOLITAN-VICKERS ELECTRICAL CO. (MEDITERRANEAN), LTD.—Winding up voluntarily. Liquidator, Mr. A. R. Smith, 5, London Wall Buildings, Finsbury Circus, E.C.

C. H. ROBERTS, LTD.—Particulars of claims by April 20th to the liquidator, Mr. C. F. Saffery, 14, Old Jewry Chambers, E.C.

WYE LIGHTING, HEATING & POWER CO., LTD.—Winding up voluntarily. Liquidator, Mr. O. Ashby, "Brookside," Church Road, Whitstable.

BLUCK ELECTRIC WELDING MACHINES, LTD.—Winding up voluntarily. Liquidator, Mr. J. T. Bunch, Bridge Street, Walsall.

Dissolution of Partnership

CENTRAL MANUFACTURING CO., manufacturers of electrical measuring instruments, &c., 6, Birmingham Road, Walsall.—Mr. A. Chinn and Mr. H. Butler have dissolved partnership. Mr. Butler will attend to debts and carry on the business.

The London Electricians' Strike

The strike of electricians employed by electrical contractors throughout the London area continued all last week. The dispute originated at the new Ford motor works at Dagenham, where a firm declined to pay the London rate to its electricians. The National Federated Electrical Association regarded the continuance of the strike at Dagenham as a breach of agreement, and withdrew from the whole of the men in the London area the 5 per cent. temporary addition to wages which had been paid for a long period. In consequence of this the Electrical Trades Union called out all its contracting-industry members.

Last week the N.F.E.A. offered to restore the 5 per cent. if the Union consented to submit the Dagenham dispute to an independent arbitrator. This offer was made to the national executive committee; the London district committee considered that it should have been invited to participate in the negotiations, and as we go to press the strike is still in progress.

E.D.A. and the Ideal Home Exhibition

The British Electrical Development Association is not actually exhibiting at the Ideal Home Exhibition this year (April 7th-May 2nd), but by arrangement with the Universal Housing Co., Rickmansworth, will be responsible for the entire lighting and wiring of a house, and a number of domestic appliances will be exhibited. The Association will have an attendant in charge to distribute literature and to deal with visitors' inquiries. The objects of the E.D.A. Electric Home Campaign have been kept prominently in mind in connection with this co-operative effort, and it is hoped that one of the results will be to promote wider use of the E.D.A. Electric Home Wiring Specification. The Association is also collaborating with the electrical concessionnaire of the "Hush-Hush House" with regard to the exhibition of domestic electrical appliances.

Association of Ex-Siemens' Men

The third dinner of this Association was held on March 24th, at Gatti's Restaurant, Strand, when Mr. J. Christie occupied the chair. Mr. J. Snow Huddleston was re-elected honorary treasurer and secretary for the ensuing year, and he will be pleased to forward all details to any intending members. During the evening the members were entertained by an excellent variety programme by well-known artistes.

The B.E.A.M.A. Index of Activity

The above-mentioned index gives a figure of 82.0 for February last (1924=100), as compared with 94.6 in January and 117.8 in February, 1930. The amount of electricity generated by authorised undertakers during February, on the 1924 basis, was 198.1, against 225 in January and 194 in February last year.

An Inquiry from America

The February *Journal* of the British Empire Chamber of Commerce in the United States states that an American firm of distributors of automative, electrical and radio equipment is desirous of getting into touch with concerns in Great Britain having kindred lines to offer for sale which are interested in developing their trade in the United States. The address of the Chamber is 25, Broadway, New York.

Australian Duty Postponed

Among the articles the deferred duties upon which have been further postponed by the Australian Customs authorities, are electric household dish-washing machines. The new date is April 1st, 1932.

The Marking of Imported Compressors

A draft Order-in-Council under the Merchandise Marks Act has been laid before Parliament requiring imported air or gas compressors or exhausters worked by mechanical power to be marked with an indication of their origin.

French Cable Makers' Agreement

While continuing as distinct undertakings, a working agreement has just been arranged between the Société des Tréfileries et Laminoirs du Havre and the Société Electro-Câble of Paris.

Municipal Competition at Darlington

The Darlington Chamber of Trade, at its annual meeting last week passed a resolution instructing the council of the Chamber to investigate fully the complaints made by the local electrical contractors that the Corporation electricity showrooms were in unfair competition with private traders in the purchase and sale of domestic electrical appliances. The chief ground of the complaint was that the Corporation was using a preferential ten per cent. discount to sell appliances on hire-purchase terms at only two per cent. interest, a rate with which private traders could not compete. It is proposed to seek an interview with the Town Council to discuss the matter.

Americans Acquire Indian Supply Companies

It is reported that by acquiring a majority interest in the United Eastern Agencies, Ltd., Bombay, the American and Foreign Power Co. has secured the control of the Karachi, Poona and Broach Electric Supply Companies. This acquisition is expected to result in a speeding-up of electrical activities in the cities concerned. The minority stock of United Eastern Agencies, Ltd., is owned by prominent Bombay residents, some of whom possess holdings also in Tata Hydro-Electric Agencies, in which American and Foreign Power owns a 50 per cent. interest. Tata Hydro-Electric Agencies, Ltd., manages important hydro-electric properties in the Bombay district. It will be remembered that the American and Foreign Power Co. purchased the Shanghai municipal electricity undertaking in 1929, forming the Shanghai Power Co. for the purpose.

The Radio Manufacturing Industry

Some idea of the magnitude of the radio manufacturing industry of Great Britain is given by the *Wireless and Gramophone Trader* as the result of a census which it recently took among the leading manufacturers. It is estimated that about 600,000 complete receivers or "kits" were sold, these having a total value of £7,000,000. Valves sold, apart from those included in complete sets, numbered 5,300,000 (value £2,600,000); 8,500,000 h.t. batteries and l.t. accumulators were sold (value £3,400,000); and the value of all other components sold, including loud speakers and mains units, was £7,000,000, making a total of £20,000,000.

The Buenos Aires Exhibition

The success of the British Empire Trade Exhibition since its opening on March 14th has so far exceeded expectations that it is unofficially announced that the Exhibition will be continued beyond the fixed closing date, April 27th. The *Buenos Aires Herald* states that the attendance during the first ten days of the Exhibition exceeded 300,000. This figure is far greater than that expected by the promoters, whose preliminary estimates of the attendance for a six-week period were not more than half-a-million.—*Reuter* (Buenos Aires).

New Catalogues and Lists

BENJAMIN ELECTRIC, LTD., Tariff Road, Tottenham, N.17.—The "Benjamin Reflector," containing articles upon the correct illumination of works and other buildings and upon various phases of lighting.

WOLF & MORGAN, LTD., 66, Victoria Street, S.W.1.—A stock list of a.c. and d.c. motors, mainly of fractional h.p. sizes. Priced.

The BRITISH RADIOSTAT CORPORATION, LTD., 29, George Street, Hanover Square, W.1.—Two illustrated brochures dealing respectively with the "Stenode Radiostat" broadcast receiving set and the "Stenode Radiostat" system of multiple telegraphy.

The DRAYTON REGULATOR & INSTRUMENT CO., LTD., West Drayton, Middlesex.—An illustrated leaflet giving particulars of thermostatic switches for use on water heaters. Priced.

SAMUEL WHEELER, LTD., Soho Works, Oldbury, Birmingham.—An illustrated catalogue of steelwork for electrical purposes, including switch cubicles, generator casings, &c.

The QUEEN'S ENGINEERING CO., 60, Queen's Road, Battersea, S.W.8.—Lists of motors for sale and hire, and dynamos and motor-generators for sale.

J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—An illustrated price list of the company's "Compact" switch-sockets of various patterns.

The BRUSH ELECTRICAL ENGINEERING CO., LTD., Falcon Works, Loughborough.—Publication No. 500, illustrating and describing the construction of the company's "Type N" induction motors and giving full details and dimensions of the whole range.

The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—A well-illustrated brochure containing interesting information regarding the company's marine auxiliary generating sets.

The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—A folder illustrating the uses of night load (time-switch) meters, with diagrams of connections for special purposes.

A. EMANUEL & SONS, LTD., 9-13, George Street, Manchester Square, W.1.—A folder presenting many examples of artistic lighting fittings in glass, wood and metal. Priced.

DORMAN, LONG & CO., LTD., 55, Broadway, Westminster, S.W.1.—A booklet containing illustrations of numerous examples of electrically-welded steelwork of an electrical character.

The STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, E.C.4.—The company's general catalogue (No. 1236) divided into three sections: Air systems and plants; fans; and apparatus. The publication is copiously illustrated.

CARRON COMPANY, Carron, Falkirk.—No. IV of the "Famous Men and Carron Works" series, containing a brief biography of James Bruce, with whom the company entered into a lease in 1760.

CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, Manchester.—A replica of a full page advertisement which appeared in a daily newspaper on March 27th, dealing with "Exide" batteries.

BROOK MOTORS, LTD., Empress Works, Huddersfield.—A wall calendar with monthly slips to April, 1932, illustrating one of the company's motors.

Messrs. ALLEN WEST & CO., LTD., Brighton.—A folder containing illustrations of, and notes on, control pillars for d.c. motors for marine and industrial purposes.

E. K. COLE, LTD., Ekco Works, Southend-on-Sea.—A pamphlet setting forth the company's "service" scheme for purchasers of its radio equipment.

S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.1.—List L.S. 125 containing illustrations, particulars and prices of "Selco" electric sirens and equipment.

The WESTINGHOUSE BRAKE & SAXBY SIGNAL CO., LTD., 82, York Road, King's Cross, N.1.—Three illustrated descriptive pamphlets: No. 11, dealing with the Westinghouse metal rectifier; No. 19, the eddy-current rail brake; and No. 20, centralised traffic control.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—A folder announcing a new range of a.c. automatic motor control gear; illustrated.

The IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Publication No. 6599 bearing illustrated descriptions and prices of the "Pentrovol" transverse current microphone and control unit.

The International Illumination Congress

British makers of floodlighting projectors are invited to send particulars of their apparatus to Mr. P. Good, 28, Victoria Street, S.W.1, for the use of the committee responsible for the preparations in connection with the forthcoming meeting of the International Illumination Congress.

Social Event

The Electrical Contractors' Section of the Southend, Westcliff and District Chamber of Trade held its first supper-ball at the Palace Hotel, Southend, on March 25th. Mr. R. B. Emerson presided. Ald. R. Tweedy Smith proposed the toast of "The Electrical Contractors' Section of the Chamber of Trade," and said that anything that concerned the safety of the public such as electricity, ought to be in the hands of persons who had proved their competence to safeguard the lives of the burgesses of any borough. The tendency in all parts of the world that he had visited was to prevent anyone carrying on any business without a licence. In responding, the chairman said that the section was formed eight years ago and it was as the result of their efforts that the rules and regulations for house wiring were introduced by the Corporation last December.

Trade Announcements

The HART ACCUMULATOR CO., LTD., has appointed as its representative in Scotland Mr. L. B. Farmiloe, who for a number of years was employed by the company in a similar capacity in the Birmingham district. The address of the Glasgow branch is 107, Wellington Street.

RADIOVISOR PARENT, LTD., has removed to 28, Little Russell Street, Holborn, W.C.1.

The Calcutta branch of the CHLORIDE ELECTRICAL STORAGE CO., LTD., has been removed to 4, Lyons Range, Calcutta.

The offices of the JACKSON ELECTRIC STOVE CO., LTD., will be closed for the Easter holiday from Thursday evening, April 2nd, until Wednesday, April 8th.

The EDISON SWAN ELECTRIC CO., LTD., discontinued the agency for the distribution of "Thor" appliances as from April 1st.

The KERSONS MANUFACTURING CO., LTD., has moved its London branch to larger premises at 35, Percy Street, Tottenham Court Road, W.1. (Telephone: Museum 9727.)

Messrs. ROSE & PARTRIDGE, LTD., have moved to new premises at 5/8, Finsbury Court, Finsbury Pavement, E.C.2, where they have a more spacious showroom.

Recent Contracts

The Elgin Electric Supply Co., Ltd., has ordered from Messrs. RUSTON & HORNSBY, LTD., a six-cylinder Ruston vertical airless injection cold starting oil engine of 600 b.h.p. There are already three "Ruston" engines in the Elgin station with a total rating of 400 h.p.

The War Office has placed a contract for a complete boiler unit for Woolwich Arsenal with JOHN THOMPSON WATER TUBE BOILERS, LTD., Wolverhampton. The company has also received an order from the London County Council for two complete boiler units for the County Hall

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price March 31st.	Fortnight's inc. or dec.
a	Acid, Oxalic... ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet	1/1 to 2/9	...
b	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£116	£3 dec.
	Grade II ... ... ,, ,,	£84	£1 dec.
	Grade III ... ... ,, ,,	£50	£1 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	7¾d.	½d. dec.
c	,, Tubes (Solid drawn) ... ,,	9½d. to 10d.	...
c	,, Wire, basis ... ... ,,	8½d.	½d. dec.
c	Copper Tubes (solid drawn) ... ,,	11d.	...
g	,, Bars (best selected) ... per ton.	£77	
g	,, Sheet ... ... ,,	£77	...
g	,, Rod ... ... ,,	£77	
g	,, (Electrolytic) Bars ... ,,	£4 12s. 6d.	£1 dec.
d	,, ,, Sheets... ... ,,	£143 10s.	...
d	,, ,, Wire Rods ... ,,	£59 12s. 6d.	£1 dec.
d	,, H.C. Wire ... per lb.	7¾d.	¼d. dec.
f	Ebonite Rod... ... ... ,,	2/8 to 2/6	...
f	,, Sheet ... ... ,,	2/8 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine... ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	4½d.	...
i	Iron, Pig (Cleveland No. 3.) ... per ton.	58/6	...
l	,, Wire, galve. No. 8, P.O. qual. ,,	£20	...
g	Lead, English pig... ... ... ,,	£13 10s.	£1 dec.
g	Mercury ... ... per bot.	£22 7s. 6d. to £23 10s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/0½d.	...
p	,, ,, rolled strip & sheet ,,	1/1d.	...
p	,, ,, wire ... ... ,,	1/1½d.	...
o	Platinum ... ... per oz.	£5 10s.	5s. dec.
d	Silicium Bronze Wire ... ... per lb.	9½d.	...
r	Steel, magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton.	£121 to £122	£3 10s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	2/11d.	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew Ltd
n P. Orminston & Sons.
o Johnson, Matthey & Co., Ltd
p C. Clifford & Son, Ltd.
r W. P. Dennis & Co.

Electricity Supply

Lighting, Domestic, Power

Barking.—NEW METERS.—The Urban District Council Electricity Committee has received sanction to the borrowing of £10,000 in respect of the purchase of meters.

LOAN.—Application is to be made for sanction to a loan of £6,372 for laying mains and services for the supply of electricity to part of the Becontree Estate.

Brighton.—GRIT PREVENTION.—At a recent meeting of the Corporation Electricity Committee the engineer reported that the experimental grit collecting devices would not afford a permanent solution of the problem, and he therefore proposed to proceed with a scheme he had devised and which he believed would overcome all further trouble. The work would cost £1,500 per boiler as the draught fan would have to be redesigned and a motor of larger capacity installed. He was instructed to proceed with the scheme.

SUPPLY TO HOUSING ESTATE.—The General Purposes Committee has received a statement from the Lighting Committee approving a report of the electrical engineer with reference to the proposed electrical equipment of the 193 houses to be erected on the Whitehawk housing estate, suggesting a fixed charge of 1s. 5d. per week for electricity and 1s. 1d. per week rental for electrical apparatus (electric cooker, kettle, washboiler, and iron), all to be maintained by the Electricity Department, electricity to be supplied through prepayment meters at the rate of ½d. per kWh. The proposal was approved and the borough surveyor authorised to make arrangements with the contractor, and the electrical engineer for the necessary installations.

LOAN.—The Corporation Electricity Committee is applying for sanction to borrow £6,000 for the purchase of electrical apparatus to let out on hire.

Bury (Lancs.).—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £19,250 for mains, &c., in connection with the change-over.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Premier of Manitoba, in a recent speech before the Manitoba Legislature, discussed the advisability of setting on foot the investigation of a project for the development of hydro-electric energy from the Saskatchewan River. The power project, if eventually undertaken, would be the largest likely to be attempted in Manitoba, having a possible capacity of 400,000 h.p. The power station would be erected on the Dauphin River 140 miles from Winnipeg. Besides bringing an immense supply of power within convenient transmission distance of the City of Winnipeg, the proposed development on the Dauphin River would facilitate the distribution of power in the urban and rural districts of Western Manitoba. The site would be within 150 miles of the Saskatchewan boundary, and the development would complete the Province's transmission system, assuring to all areas reasonably low priced hydro-electric power sufficient for many years to come. The Manitoba Government owns 935 miles of transmission lines, of which 325 miles were constructed last year. Although a number of lines still remain to be constructed, the main network is now established. By the purchase of the Brandon plant at the end of 1930 an important addition was made to the Provincial hydro-electric system. Revenues received by the Manitoba Power Commission last year reached $350,000, and are expected to total $750,000 in 1930. The Provincial Government contemplates a revision of the constitution of the Manitoba Power Commission, to which powers will probably be granted by the Legislature, similar to those governing the operations of the Ontario Hydro-Electric Power Commission.

EXPORT OF ENERGY.—*Reuter's Trade Service* learns from Ottawa that during 1930 exports of electricity from Canada to the United States amounted to 1,619,602,712 kWh, or approximately 9 per cent. of the total output. Of this, 402,317,877 kWh was surplus power exported by the Hydro-Electric Power Commission of Ontario and the Canadian Niagara Power Company from the Niagara plants. Only 6,035,011 kWh was imported.

Continental.—AUSTRIA.—A new 25,000-kW high-pressure steam turbo-generator has recently been installed at the municipal power station in Vienna. The turbine, which was built by the Waggon und Maschinenbau Gesellschaft, of Gorlitz, is of the twin-casing type, and uses steam at a pressure of 32 atmospheres and at a temperature of 400 deg. C. The generator, constructed by the Austrian Siemens-Schuckert Works Co., generates power at 5,200 V at 3,000 r.p.m.

POLAND.—It is reported from Warsaw that a syndicate in which the Polish Grodek Electricity Works Co. and Motor Columbus are interested has drawn up a scheme for the erection of a large power station in Western Poland for the supply of electrical energy to the many small towns in that area of the country.

Cookham.—NEW ELECTRICITY CHARGES.—The Cookham and District Electricity Corporation, Ltd., has adopted the following new scale of charges: Flat rate, 10½d. per kWh; two-part tariff, excess "unit" charge, 1½d.; power and heating, up to 3,000 kWh per quarter, 3d. per kWh; beyond 2d. per kWh.

Croydon.—LOAN SANCTIONED.—The Corporation has received sanction to borrow £50,000 for the extension of mains.

Eastry.—ELECTRICITY SUPPLY.—The Rural District Council has decided not to oppose the application of the South-East Kent Electric Power Co., Ltd., for permission to construct overhead lines and underground mains for a supply of electricity to Eythorne, Waldersbare, Kilmanstone, and Northbourne.

Fleetwood.—YEAR'S WORKING.—It was announced at a meeting of the Town Council, on March 25th, that the year's profits from the electricity department were £6,150.

Harwich.—PRICE REDUCTIONS.—We are informed by Mr. J. H. Shepherd, borough electrical engineer, that the estimated net profit for the year ended March 31st is £1,715, and in consequence the charges for electricity have been reduced, the new scale to take effect from the March quarter readings. The reductions are:—Lighting: From 6d. per kWh to 5½d. for the first 200 kWh per quarter, 5d. for the next 200, and 4½d. per kWh for all energy in excess of this amount. Heating and cooking: From 1½d. per kWh to 1¼d. for the first 500 kWh per quarter during the winter months, and 1d. per kWh for the first 500 kWh in the summer quarters. All excess energy, ¾d. per kWh. Rateable value system: From 15 to 12½ per cent. per annum of the net rateable value, and the "unit" charge reduced from 1½d. to 1¼d. for the first 300 kWh per winter quarter and 1d. for the summer quarters; all additional energy at ¾d. per kWh. A special rate of ¾d. per kWh has been introduced for water heaters.

India.—ELECTRICAL DEVELOPMENT.—In his annual report for 1929-30 the Director of Industries, Bengal, outlines the direction in which industrial conditions in the Province could be materially improved with electricity as the chief motive power. He observes that there are signs of a decided movement towards the establishment of small-scale industries worked by cheap power in other provinces of India, and that this will naturally influence the outlook in Bengal and help to solve the problem of industrial development. The electrical distribution schemes in the Punjab, the United Provinces and Madras are the schemes referred to. In the United Provinces some 10,000 sq. miles of country comprising 42 districts and small towns with an aggregate population of nearly a million will be provided with a grid system operating at 33,000 and 11,000 V. This scheme will provide cheap power for irrigation, pumping, and agricultural purposes as well as for industrial and domestic use and street lighting in the towns and villages. Discussing the practicability of a similar scheme in the province of Bengal, the Director of Industries says that in the Teesta and other rivers which flow into Bengal, more potential electric power is continually going to waste than would be required for all the present schemes in the Punjab and the United Provinces together. If, after a careful inquiry, it were shown to be possible to establish a large hydro-electric generating station or stations in Bengal territory, it would then be possible to make the necessary plans for a grid distribution system that would ultimately cover the whole province.—*Reuter's Trade Service* (Bombay).

Lancaster.—PRICE REDUCTION.—At the last meeting of the Town Council it was announced that owing to the success of the Electricity Department it had been decided to reduce the charges on the flat rate from 8d. to 6d. per kWh. Since 1926 reductions had been made averaging £2,400 per annum. The rural supply had been very successful, the demand from Hest Bank, Slyne, and Bolton-le-Sands had been better than anticipated. The Department was commencing next month to lay cables to Hatton, Caton, and Brookhouse, which would be supplied with electricity this summer. It had laid 18 miles of cables from Bailrigg to Bolton-le-Sands.

London.—BERMONDSEY.—The Borough Council Electricity Committee is to install additional plant in the Almond Road district to cope with the estimated demand for electricity next winter, and an option has been obtained on certain railway arches in Almond Road where it is proposed to install a bank of mercury-arc rectifiers. The estimated cost of the proposal is £5,600.

BATTERSEA.—The Borough Council Electricity Committee is to provide the following plant:—Lavender Hill sub-station, 750-kW motor convertor with automatic switchgear, &c. (£6,270); generating station, 2,000-kW induction motor generator for supplying power to the station auxiliaries, together with switchgear, &c. (£9,053); circulating water pump with control gear, pipework, &c. (£2,083); and extension to the works power switchboard (£2,007).

The Committee is to provide electricity services to 119 premises, at a cost of £1,124; extend mains for private services in Nine Elms Lane, at £83; replace with armoured cable old vulcanised bitumen distributors, at a cost of £848; and provide additional feeder from Nine Elms sub-station to the South Lambeth goods depôt, at a cost of £313.

POPLAR.—The Borough Council Electricity Committee is to extend Tomlins Grove sub-station at a cost of £5,637.

Lytham St. Annes.—ELECTRICITY SUPPLY.—There was a further development in the Corporation's electricity undertaking on March 25th, when the Mayoress (Mrs. Ingham) switched on a 33,000-V supply from Preston Ribble power station. A second supply at 6,000 V was switched on by Mrs. Sharman, wife of the chairman of the Electricity Committee. For five years Lytham St. Annes has not been able to cope with the demand for electricity. An e.h.p. supply has been obtained

from Blackpool Corporation, which last year supplied the town with 8,172,400 kWh.

Newbury.—ELECTRICITY SUPPLY.—The Urban Electric Supply Co., Ltd., reports that owing to the difficulty in maintaining the pressure in the Wash Common area of Newbury, on account of the additional demand for electricity, steps will have to be taken immediately to alter the system to the standard, and it proposes to install suitable transforming apparatus in the area, for the supply of a.c. The present supply is by d.c. at 240 and 480 V. The altered supply will be at 50 cycles.

Scarborough.—UNEMPLOYMENT GRANT.—The Town Council has secured a grant from the Unemployment Grants Committee in connection with the extension of the electricity supply to Ravenscar, which will cost £5,255, and to Stanton which will cost £8,019.

Stoke-on-Trent.—CHANGE-OVER.—At a recent meeting of the Corporation Electricity Committee, the engineer reported upon the question of change-over of supply of the Birches Head and Far Green areas, Hanley, and it was decided that l.p. 3-phase mains should be provided between the proposed sub-station and Providence Square sub-station for this purpose. The work is estimated to cost £2,500.

H.P. MAINS.—The Committee is to re-lay the h.p. main in Victoria Road, Fenton, at an estimated cost of £1,200.

SUPPLY TO HOUSING ESTATE.—The question of supplying houses in course of erection on the May Place estate, Basford, has been considered, and the Committee has decided, subject to the builders wiring the houses with lighting and heating circuits throughout to the specification issued by the Department, to extend mains at an estimated cost of £1,100.

Stroud.—PRICE REDUCTIONS.—The Stroud Electric Supply Co., Ltd., has reduced the flat rate for lighting to 7½d. per kWh, the power and heating rate to 3d. per kWh up to 3,000 kWh per quarter, and to 2d. per kWh beyond, and the excess "unit" charge on the two-part tariff to 1½d. In future no cash discounts will be allowed.

Traction Notes

Burnley.—MOTOR 'BUSES.—The Transport Committee on March 27th sanctioned the substitution of 'buses for tramcars as soon as practicable on the Harle Syke and Rosegrove route. It has recommended the purchase of 16 double-decker 'buses at a cost of £27,200, and an expenditure of £1,400 on filling in the track on the route to be abandoned.

Birmingham.—NEW RAILLESS CARS.—The Corporation Tramways Committee reports that the time has arrived when the original railless cars, which commenced operations in 1922, should be replaced, as they have now exceeded their useful life. The Committee has, therefore, decided to purchase eleven new railless vehicles at an estimated cost of £2,000 each.

Chile.—SANTIAGO.—Plans for the construction of an underground railway at Santiago between the Alameda and Yungay railway stations are now under consideration. Thirty months would be required to complete the scheme and the cost would be 6,500,000 pesos (£162,500).—*Reuter's Trade Service* (New York).

Japan.—OSAKA.—Work is in hand on the construction of an underground electric railway in Osaka. The line, which will run through the centre of the town from north to south for a distance of over ten miles, is expected to be completed early next year, and will be operated on the third-rail system utilising d.c. at 600 V.

London.—UNDERGROUND RAILWAY BILL.—The petition of the Underground Railway Companies for leave to introduce a late Bill for an extension of the Bakerloo Railway to Camberwell, came before the Examiners of Private Bills on March 26th. The Examiners will report that the petition has not complied with the Standing Orders in respect of the publication of notices and deposit of the Bill within the time allowed. A memorial against dispensing with the Standing Orders was handed to the Examiners on behalf of the Southern Railway Co.

Leicester.—TRACK RENEWAL.—The *Electric Railway, 'Bus and Tram Journal* states that the Tramways Committee has sanctioned a scheme for relaying three-quarters of a mile of the tramway track on the widened portion of Belgrave Gate. The cost is estimated at £19,000.

Manchester.—ALTRINCHAM RAILWAY ELECTRIFICATION.—The electrification of the Manchester-Altrincham railway is nearing completion, and it is reported that the new service will commence on May 11th.

Sunderland.—TRAMWAY IMPROVEMENT SCHEME.—The Corporation Tramways Committee is to consider a proposal to spend £51,000 on improvements to the tramway system. The proposed scheme, it is stated, would involve large reductions in maintenance costs and give greater comfort to the public. It has been suggested that 12 existing car trucks and equipment should be scrapped, and that 26 trucks and equipment should be bought for accommodating car bodies reconstructed in the tramway workshop at an estimated cost of £33,750. It is also suggested that 12 cars similar in design to those used in Leeds should be bought at a cost of £18,000.

Telegraph and Telephone

Atlantic Cable.—CUT WITH SAW.—One of the London-New York transatlantic submarine telegraph cables of the Commercial Cable Co. ceased to function at 11.50 a.m. on March 1st. On being raised by a repair ship its was found to have been severed two miles S.S.W. of the Breaksea Lightship in the Bristol Channel. A reward of £100 is offered for information that will lead to the conviction of the offender under the Submarine Telegraph Act, 1885. It is surmised that a ship may have dragged the cable with her anchor and that a saw was used to free herself.

Channel Islands.—NEW TELEPHONE SERVICE.—The Postmaster-General announced last week that a public service became available on March 26th between St. Helier (Jersey), St. Peter Port (Guernsey), the British mainland, and Northern Ireland.

International Telephony.—INDO-CHINA SERVICE.—The Postmaster-General announced last week that a public service had been made available between this country and the following places in French Indo-China, namely, Saigon and Cholon (Cochin-China) and Pnom-Penh (Cambodia).

The Telephone Service.—PRESTON'S AUTOMATIC SERVICE.—The change-over from manual to automatic service in the Preston area was officially inaugurated by the Mayor on April 1st.

The automatic area includes Ashton-on-Ribble and Leyland, and the apparatus is of the Strowger type. A new manual switchboard has also been installed for dealing with trunk calls.

HOUSING ESTATE CABLES.—A complete system of underground cables has been installed at the Aldwick Bay housing estate, near Bognor, as the result of co-operation between the Post Office and the directors of the estate. The use of overhead pole lines is thereby avoided, the circuits being underground right up to the houses; telephone service can therefore be provided without delay, and there is no installation fee.

Radio

France.—INTERFERENCE BAN.—The Mayor of Bihorel, near Rouen, has issued a by-law prescribing penalties for the operation of wireless sets in such a manner as to cause "howling" and other interference with reception by neighbouring listeners. —*Reuter* (Paris).

Germany.—INCREASED POWER.—The construction of new stations has been under consideration by the Post Office authorities for some months past. Sufficient funds have now been granted, according to an announcement by the Ministry of Posts, for the work to be carried out this year. Alterations at Königs Wusterhausen have already progressed so far that the increase of the *Deutschlandsender's* power by five kilowatts is likely to be achieved by the end of April. The Langenberg new 75-kW transmitter has been built and will be ready this autumn. A new high-power station will be built at Breslau, some fourteen miles from the present station, also a new large station at Leipzig, and the power of the Frankfurt-on-Main transmitter is to be increased to 25 kW. The two latter stations will exchange wavelengths when reconstruction is completed in ten or eleven months time says *World-Radio*. The Post Office has decided to erect a relay station at Trier (Treves) this year, and it will be linked up with the Cologne or Frankfur-Mühlacker group.

Poland.—CHANGE OF NAME.—The station at Raszyn, near Warsaw, which is one of the most powerful in Europe, is to change its name, and its programmes will henceforth be announced as coming from Warsaw. The change is due to the pronunciation of Raszyn being mistaken for "Russia" in Anglo-Saxon countries and follows requests from Polish diplomats abroad. The official opening of the station, which is already partly in use, will take place soon in the presence of the President of the Republic. The station was built by the Marconi Company.—*Reuter's Trade Service* (Warsaw).

Switzerland.—NEW STATION.—The new station at Sottens, in the Canton of Vaud, was officially opened on March 25th. It will transmit on a wavelength of 403.8 metres and is equipped with "Standard" plant.—*Reuter* (Berne).

The station is 17 km north of Lausanne; its masts are 125 metres high and 200 metres apart, the unmodulated power being 25 kW (40 kW). It is using Berne's wavelength, while Zurich's (459.6 metres) is to be used by the new 60-kW Beromunster station, which is also British built.

Wireless Exchanges.—CARDIFF APPLICATION.—A scheme to provide a relay service for householders in the Cardiff area has been submitted to the Corporation Public Works Committee. The promoters ask for exclusive rights to operate a "re-diffusion" service in the city and claim to have 5,000 subscribers in Hull, 1,500 in Swindon, 800 in Leith, 1,000 in Clacton-on-Sea, 1,150 in Ramsgate, and to have applied for similar rights at several other places. The applicants offer to pay the Corporation £250 per annum for every 1,000 subscribers, who will be charged 1s. 6d. each per week. Each will require to purchase a receiving licence, but the only apparatus needed will be a loud-speaker and plug adaptor to reproduce the programme relayed without choice.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Bristol.—April 9th. Electricity Department. Non-prepayment single-phase and 3-phase 50-cycle meters. (March 27th.)

Denmark.—COPENHAGEN.—April 20th. Municipal Lighting Department. Six centrifugal feed-water pumps, complete with electric motors, steam turbines, accessories and piping, for a new steam boiler plant. (G.X. 10261.)*

Dundee.—April 8th. Electricity Department. General engineering stores, &c., for the year May 15th, 1932. Specifications from Mr. D. H. Bishop, general manager and engineer, Dudhope Crescent Road. Tenders to town clerk.

April 20th. D.c. and a.c. house service meters. (See this issue.)

Dover.—April 8th. Corporation. Supply and laying of h.p. cable. (March 20th.)

Egypt.—CAIRO.—Ministry of the Interior. April 18th. Ice-making plant and accessories. (A.X. 10785.)*

April 21st. 494-kVA lighting installation. (A.X. 10804.)*

April 25th. Electricity meters. (A.X. 10817.)*

April 30th. Installation of a h.p. underground network at Zagazig. (A.X. 10816.)*

May 2nd. 250-kVA lighting installation for Asswan. (A.X. 10802.)*

April 15th. Ministry of Public Works. Diesel-electric propelling machinery for Seru oil tanker. Copy of specification and conditions of tender can be obtained from the Office of the Director-General, Mechanical and Electrical Department, against payment of 250 mills.—*Reuter's Trade Service* (Cairo).

Erith.—April 10th. Electricity Department. H.p. and l.p. switchgear and other sub-station equipment. Supply, laying, &c., of h.p. and l.p. cables. (March 27th.)

Farnworth.—April 11th. Urban District Council. L.p. cables, and l.p. boxes and pillar. (March 27th.)

Gainsborough.—Electricity Department. Two induction regulators and one 400-kVA transformer. (March 27th.)

Great Western Railway.—April 9th. Electric wires and cables, telegraph ironwork and electric lamps. (March 20th.)

India.—NEW DELHI.—April 20th. Indian Stores Department. V.i.r. lead-covered cable. (A. 10856.)*

London.—CENTRAL ELECTRICITY BOARD.—April 27th. Metering equipment for certain stations in the area of the North-East England Electricity Scheme. (March 13th.)

April 17th. Site works, foundation works and buildings at Macclesfield and Hartshead (North-West England and North Wales Scheme.) (March 20th.)

April 27th. 132,000-V outdoor switchgear for the South-West England and South Wales Scheme. (March 20th.)

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—May 13th. Piping equipment for Barking power station. (March 27th.)

LONDON AND HOME COUNTIES JOINT ELECTRICITY AUTHORITY.—Supply and erection of overhead 11-kV 3-phase transmission line, complete with transformers, &c. (March 20th.)

Meters and transformers. (March 27th.)

LONDON COUNTY COUNCIL.—April 20th. Wiring and fittings for electric lighting, &c., in tenement dwellings on the Tabard Garden estate, Southwark. (See this issue.)

Manchester.—April 10th. Waterworks Committee. Electrically-driven air compressor, pipes, valves, &c. (complete tenders only). Specifications (deposit £2 2s.) from engineer, Waterworks Department, Town Hall.

April 17th. Electricity Department. Transformers, motors, time switches, meters, and kettles. (See this issue.)

New Zealand.—WELLINGTON.—May 27th. Post and Telegraph Department. Branch telephone equipment. (A.X. 10812.)*

May 4th. Telephone keys, resistance spools and transmitter buttons. (A.X. 10844.)

May 5th. Public Works Department. 66-kV and 33-kV outdoor switchgear for Lake Coleridge. (A.X. 10722.)*

May 19th. 2,250 e.h.p. suspension insulator strings, complete with fittings.

June 2nd Two outdoor type automatic induction voltage regulators. (A.X. 10845.)

Nottingham.—April 24th. Corporation Passenger Transport Department 25 double-deck trolley vehicles, and supply and erection of overhead equipment. (March 27th.)

Portland.—April 10th. Urban District Council. Transformer sub-station switchgear. (See this issue.)

Portsmouth.—Electricity Department. Six kiosks, two 500-kVA Scott-connected transformer groups, and twelve 50-kVA single-phase transformers. (March 27th.)

Salford.—April 9th. Electricity Department. Stores, including electrical apparatus and materials. (March 20th.)

South Africa.—PARYS (ORANGE FREE STATE).—May 30th. Municipal Council. Generating plant and distribution equipment. (A.X. 10849.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Aberdeen.—Corporation Education Committee. Accepted:—
Electrical work (£250).—Aberdeen Electrical Engineering Co., Ltd.

Barking.—Electricity Committee. Recommended:—
E.h.p. switchgear for Lodge Lane sub-station (£368).—A. Reyrolle & Co., Ltd.
L.p. switchgear (£300).—J. G. Statter & Co.

Brighton.—Tramways Committee. Recommended:—
Trolley wire (£131).—Whitecross Co., Ltd.
Lamps (£103).—Poynter, Griffiths & Co., Ltd.
Cable (£312).—Superlamp, Ltd.

Holyhead.—Urban District Council. Accepted:—
Cable and house-service boxes.—British Insulated Cables, Ltd.
Meters.—Robert Hornby & Co.
Tee boxes.—J. Jones.
Compound.—Berry Wiggins, Ltd.

Hull.—Telephones Committee. Recommended:—
Cable (£514).—W. F. Dennis & Co., Ltd.
Switchboard (£89).—Ericsson Telephones, Ltd.
Electricity Committee. Accepted:—
Electrically-operated sluice valves (£1,670).—J. Blakeborough & Sons, Ltd.

Ilford.—Electricity Committee, Recommended:—
Cable for twelve months.—Metropolitan Electric Cable and Construction Co., Ltd.; Union Cable Co., Ltd.
Rectifier plant (£2,350) and l.p. switchgear (£305).—Whipp and Bourne, Ltd.
H.p. switchgear (£449).—Crompton Parkinson, Ltd.
Truck and h.p. switchgear for Ley Street Works (£187).—General Electric Co., Ltd.

Lamp Contracts.—The Southern Railway has placed a large order with the British Thomson-Houston Co., Ltd., for Mazda gasfilled lamps.

The company has also received a contract for vacuum and gasfilled lamps from the London & North-Eastern Railway Co. for 12 months ending April 30th, 1932.

London. — BATTERSEA. — Electricity Committee. Recommended. Supplies for twelve months:—
Cables.—Callender's Cable & Construction Co., Ltd.
Electricity meters.—Chamberlain & Hookham, Ltd; Ferranti, Ltd.
Bitumen.—Dussek Bitumen Co., Ltd.
METROPOLITAN WATER BOARD. Recommended:—
Water turbine driven electric generator for Deptford pumping station (£355).—Boving & Co., Ltd.
L.C.C.—Highways Committee. Recommended:—
Two 60-b.h.p. motors with control apparatus for ventilating fans in Rotherhithe tunnel (£648).—Crompton Parkinson, Ltd.
Housing Committee. Accepted:—
Wiring and fittings for electric lighting in six blocks of dwellings in course of erection on Clapham Park estate (£1,807).—City Electrical Co.
Wiring and fittings for electric lighting in five blocks of dwellings in course of erection on Stamford Hill site (£1,410).—A. Meckhonik.

Newcastle-upon-Tyne. — Newcastle-upon-Tyne Electric Supply Co., Ltd. Accepted:—
Main pipe-work required at the Dunston power station (£120,000).—Aiton & Co., Ltd.

Rotherham.—Public Assistance Committee. Accepted:—
Electrical supplies for six months.—E. J. Brown & Co., Ltd.

Salford.—Finance Committee. Recommended:—
Manual switchboard for exchange at Salford town hall (£225).—Reliance Telephone Co., Ltd.
Electricity Committee. Recommended:—
Metal-clad switch unit (£122).—Metropolitan-Vickers Electrical Co., Ltd.

Stoke-on-Trent.—Sewage Committee. Accepted:—
Electric lighting at Longton works (£62).—Potts & Co.
Electricity Committee. Accepted:—
New positive plates for battery at Burslem station (£392).—Pritchett & Gold and E.P.S. Co., Ltd.
Supply of cables and laying of mains for 12 months.—Callender's Cable & Construction Co., Ltd.
E.h.p. truck type switchgear for 12 months.—Metropolitan-Vickers Electrical Co., Ltd.
Electric vehicle battery (£127).—Tudor Accumulator Co., Ltd.
Static transformers for 12 months.—English Electric Co., Ltd.
Public Assistance Committee. Accepted:—
Electric collar ironer for Turnhurst Road Hospital (£137).—Cherry Tree Machine Co., Ltd.
Highways Committee. Accepted:—
Traffic signals.—Chance & Co., Ltd. (£154); Revo Electric Co., Ltd. (£150).

Forthcoming Events

Institution of Electrical Engineers.—(*North-Western Centre*).—Tuesday, April 7th. Engineers' Club, Manchester. 7 p.m. Annual meeting. "Heavy-duty Rectifiers and their Application to Traction Sub-stations." Mr. J. W. Rissik and H. Rissik. *Hampshire Sub-Centre.*—Wednesday, April 8th. University College, Southampton. 7.30 p.m. "The Breaking Performance of High-power Switchgear and of a New Form of Quenched-arc Switch." Mr. L. C. Grant. *North-Western Students' Section.*—Thursday, April 9th. Visit to the Manchester studio and transmitting station of the British Broadcasting Corporation.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

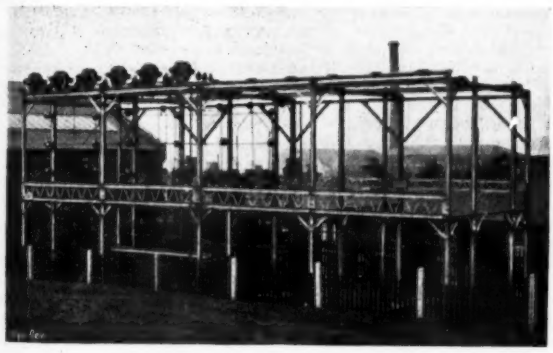
Makers of "Charteris" vibrator.

Notes

North-West Midlands J.E.A.

The illustration reproduced herewith is of the outdoor step-down station constructed by the Metropolitan-Vickers Electrical Co., Ltd., and designed by the Engineers' Committee of the North-West Midlands Joint Electricity Authority for giving bulk supply to Congleton Corporation. The chairman of that Committee is Mr. C. H. Yeaman, and the other members are Mr. H. A. Tulloch, Mr. S. Lambert, Mr. A. J. C. de Renzi, and Mr. W. H. Robins.

The 22-kV lines come in from the south to the Ferranti surge absorbers to be seen on the top of the steel structure. An air-break switch controls each of the two lines. The current



then goes to a set of bus-bars, passes through current transformers (which can be seen in the middle of the structure) and rises again to another set of bus-bars, from which the current is taken by two air-break switches to the Corporation terminals, where the responsibility of the Joint Authority ends.

The Joint Authority gave Mr. Arthur Ellis, consulting engineer to the Congleton Corporation, permission to put the 750-kVA, 22,000/400 and 230 V step-down transformers inside the danger area and on the site of the sub-station, and from these terminals the Congleton Corporation takes its supply into the building owned and erected by it. This building, a portion of which may be seen on the left hand of the illustration, was designed by Mr. Arthur Ellis.

A New Lighting Effect

Behind one of the arches of the main lecture theatre of the E.L.M.A. Service Bureau a new colour demonstration has been built in the form of a semi-cylindrical recess surmounted by a half dome of white plaster. Lighting circuits in three colours installed in the cornice below this dome enable many beautiful patterns in contrasting colours to be thrown upwards, giving a practical demonstration of "painting with light." The lower part of the demonstration comprises a series of curved white surfaces of various cross sections which are illuminated on the indirect priciple by lamps concealed in their recesses. Here again the use of three-colour circuits in each section gives a wide lattitude of effect and the gradations of illumination are particularly striking on account of the vivid colour contrasts obtainable. An interesting point in connection with this demonstration is the fact that all the surfaces appear to be self-luminous, although they are actually acting as reflectors.

The object of this demonstration is to indicate to architects how intimately the subject of form is bound up with that of lighting, and how the best results are obtained when the two are carefully designed in relation to each other. There seems to be little doubt that for decorative purposes, correctly applied colour lighting has a great future before it, and the E.L.M.A. Service Bureau is anticipating such developments in this new lighting demonstration.

After-glow in Discharge Tubes

During investigations in connection with electrical discharges through various types of tubes, a correspondent to *Nature* observed some peculiarities of the after-glow which appear to be worth recording. It is well known that the intensity and duration of the after-glow depend on the material of which the tubes are made. It is also believed that the duration of the after-glow ranges from a few seconds to a few minutes.

While working with silica tubes filled with gases at rather low pressures, he noticed a strong after-glow which persisted for about three-quarters of an hour. The tubes were excited by a small induction coil giving 400 volts for its output, and the discharge was passed for two minutes. During this time the tube did not show any appreciable rise in temperature. This phenomenon can be repeatedly observed any number of times. The after-glow in silica tubes is given not only by nitrogen and metallic vapours, but also appears to be associated with almost all gases, as well as metallic vapours. The glow is greenish when the current is switched off; but it soon develops into a yellowish white cloud filling the whole of the discharge tube, the density of illumination in the capillary portion being distinctly much higher than in the remaining portion of the tube.

The rate of decay of this glow is extremely slow, and its intensity appears to be largely controlled by the pressure of the gas—lower pressures, ranging between 0.01 mm. and 0.4 mm. of mercury, being very favourable to large intensity. The glow in the present case showed the flickering of light for quite a long time, giving an appearance something like the scintillations observed in a spinthariscope.

Light Intensity of the Mercury Lamp.

Oscillograms given in a recent article in *Nature* show that so long as the current through the electrode is appreciable, the terminal voltage remains constant, and that so long as the terminal voltage is constant the intensity of the light emitted is directly proportional to the current.

A special direct-current mercury lamp was made of transparent fused quartz which could be used at various current densities. The light intensity of the lamp was measured by a monochrometer and a vacuum photoelectric tube. It was found that the relation between the intensity of the light G, the current I, and the potential difference V between the anode and the cathode could be expressed by a formula of the form $G = kI(V - V_0)^n$, where k and V_0 are constants; V_0 is the least potential difference between both the electrodes required to maintain the arc, and is a constant for a given lamp. For a given wave-length the number n is constant.

It was found by plotting curves having $\log (G/I)$ as ordinates and $\log (V-V_0)$ as abscissæ that, provided the potential difference was very small, the resulting curve was a straight line. The formula is an experimental one. It shows that when the temperature of the mercury vapour is raised by increasing the terminal voltage, the radiations of longer wave-length increase much more rapidly than those of shorter wave-length. This radiation, therefore, follows quite a different law from black-body radiation.

Experiments with an alternating-current mercury lamp show that the formula given still holds, provided we take the mean value of the light intensity, the effective potential difference between one of the anodes and the cathode, and the effective value of the input current. The value of n, however, is different from that for the direct-current mercury lamp

Highest Railway in Europe

If a proposal which is now before the Swiss Ministry of Traffic should come to fruition, the Jungfraujoch terminus of the Jungfrau Railway is, according to the *Railway Gazette*, likely to lose its present distinction of being the highest railway terminus in Europe. Jungfraujoch station is 11,342 ft. above sea level, but the railway which has been planned from Morteratsch—a station on the Bernina line, four miles from Pontresina— to a point near the summit of Piz Bernina, will, if carried out, attain a maximum altitude of 12,512 ft. This altitude, at which it is intended to construct a hotel as well as the station, is 1,000 ft. short of the summit of the Piz Bernina. As Morteratsch is some 6,600 ft. above sea level, the difference in level to be surmounted by the railway is 4,742 ft., for which electrically-operated rack-and-pinion working would be employed, on a maximum gradient of 1 in 3. As with the Jungfrau line, tunnelling is contemplated for the final stage, but a sheltered location, not subject to avalanches, can be found on the slopes of the Chalchagn for a considerable distance.

Electricity in the Dairy

Electrical modernisation of a large dairy plant at a cost of $42,000 promises, according to the *Electrical World*, a reduction of $7,500 annually in the total of $175,000 expended for power, labour, fuel and repairs. Refrigeration (680 tons) and power plant auxiliaries remain steam-driven, but the electrical, consumption is expected to be more than 240,000 kWh per month at 94.2 per cent. power factor. Average demand is computed at 887 kVA, with a maximum of 962 kVA.

Pasteurisation of the milk by passing current through it and establishing the requisite temperature by electrolytic losses is the process used. Six units together handle 13,200 quarts per hour and consume 48 kW each at 220 volts a.c. applied to the carbon electrodes. The balance of the plant load is represented by circulating pumps, bottle washers, ice cream machinery, conveyors, elevators, fans and blowers.

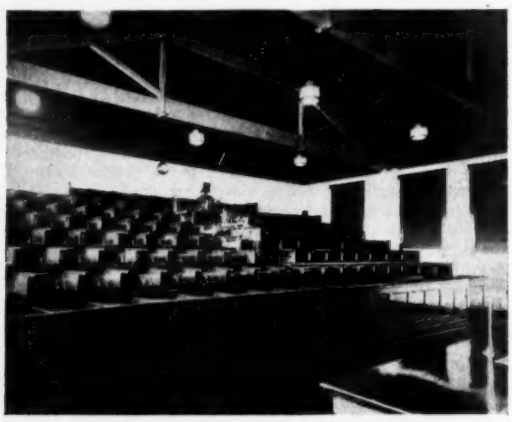
Midi Railway Electrification

Out of a route mileage, on the Midi, of 2,660 there are now 752 electrically equipped, according to the *Railway Gazette*. This distance will soon be increased to 1,155 miles, and already a third of the traffic is electrically hauled. In 1922 the first French locomotives to work at 1,500 volts d.c. ran between Pau and Tarbes. In 1927 a test run over the 123 miles between Bayonne and Bordeaux was made in 104 minutes, an overall speed of 71 m.p.h. By 1929 two trans-Pyrenean lines had been electrified.

The company itself produces all the electricity it uses. The annual consumption is about 200 million kWh, although the plant can produce 400 million kWh. The five water-power stations supply three-phase 50-cycle current at 60,000 volts. To feed certain sub-stations at 190 miles from the generating plant, current is stepped up to 150,000 volts at two transformer stations, and stepped down again at four points. The transmission lines in general follow the railway. The sub-stations are placed every 12¼ to 15¼ miles, and have either two convertors in series at 750 volts, single 1,500-volt convertors, or mercury-arc rectifiers. There are 27 automatic sub-stations. The drawn-copper trolley wire is carried by a steel cable supported at intervals of 196 ft. There are 190 locomotives in service and 40 building, each of 1,400 h.p., and capable of 56 m.p.h., with four driving axles in two bogies. The company also has ten locomotives of 2,100 h.p. each, with three rigid driving axles and a bogie at each end. They are designed for a maximum speed of 75 m.p.h. For branch-line working there are 43 motor vehicles, each of 500 h.p., carried on two bogies.

Lecture-theatre Lighting Scheme

An excellent method of meeting the requirements of lecture-theatre lighting is reported from Sydney, N.S.W. At the University there the theatre of the School of Health has just been equipped with several lighting units which incorporate rather unusual features, and in such a form that they meet the circumstances in an exceptionally successful way. The



Lighting in Sydney Lecture Theatre

units are of lantern shape, as will be seen in the night view reproduced herewith, and they are arranged for dual-circuit lighting. The main lighting source in each lantern is a "Gecoray" floodlighting unit fitted with a 200-watt lamp. Three pilot lights are affixed to the outside of the reflector (inside the diffusing glass panels), these serving to illuminate the panels and the upper part of the lecture hall. The combination of floodlights and pilot lights gives effective illumination, and the intensity on the working plane is of the order of ten foot candles.

Street Lighting in History

Even in Antioch, Rome, and a few other ancient cities there were a few public lights. During festival times the Egyptians, the Greeks, and the Romans used to hang lamps in the thoroughfares and outside their houses. An author of about the year 400 A.D. tells us how some soldiers cut the ropes by which the public lights were suspended. In the year 505 Eulogius, Governor of Edessa, ordered lamps to be kept burning in the streets and he confiscated oil which had been given to the churches and monasteries.

In modern times Paris was one of the first cities to institute street lighting. In the sixteenth century Acts were passed making it compulsory for all householders who had windows fronting the street to keep lights burning there after nine o'clock in the evening. In 1558 large vases filled with pitch, resin, and other combustibles were placed at street corners, or at shorter intervals, and it is believed that nearly three thousand of these lamps were burning at a time. Soon afterwards lanterns were substituted for torches, and in 1662 an enterprising Italian began to hire out torches by the hour, charging five sous for a torch for a coach and three sous for a pedestrian. He did not keep his monopoly long, for five years later the authorities took over the task and lanterns began to be lighted every year from the October 20th until the end of March. The citizens themselves offered to help defray the cost for they knew the perils of dark streets only too well.

So far as London is concerned the earliest suggestion of street lighting seems to be Stow's remark that in 1417 the Mayor ordered "lanthorns with lights to bee hanged out on winter evenings betwixt Hallowtide and Candlemasse." Acts of Parliament were passed in the eighteenth century, and according to a writer of 1786 London was covered with lamps usually of crystal glass each holding three wicks. In Vienna the lamps at this time were made of white glass in a globular form and covered with tin plate, painted red on the outside and polished within. They were supported on posts fixed to the houses at a height of fifteen feet from the ground.

Gas came at the beginning of the nineteenth century, and, although scoffers said it was ridiculous to think of lighting a city by burning smoke, within a few years gas lamps had ousted the old lights.

In 1878 "electric candles" were placed in positions between Waterloo and Westminster Bridges. Previously, however, in 1853 Hungerford Bridge had been experimentally lighted by electricity.

Appointments Vacant

Charge engineer for the Municipal Commissioners of Singapore.

Junior scientific officer for the Air Ministry.

Probationary engineer for the Federated Malay States Posts and Telegraphs Department.

Sales superintendent for Aylesbury Electricity Department.

(See our advertisement pages to-day.)

E.P.E.A. London Western Section

The annual dinner of the London Western Section of the Electrical Power Engineers' Association was held last Saturday at St. Ermin's, London, S.W. The toast of "the Association" was proposed by Ald. J. Samels, J.P., L.C.C. (chairman, D.J.B. No. 10), who commented upon the high professional standing of those most active in the interests of the E.P.E.A.

Response was made by Mr. A. V. Sendall (immediate past-president), who paid a tribute to the unobtrusive hard work put in by honorary local officials all over the country. He emphasised the need for organising the selling side of supply undertakings on as efficient lines as the generating, and maintained that the duty of giving service to consumers should be performed only by trained technical engineers. The achievements of the Association had been gained under a Whitley Council; if progress was sometimes slow on that account it was all the more sure.

"The Western Section" was proposed by Mr. H. W. Healy, who claimed that the original root of the Association was in South-west London and referred to some of those who dug for foundations, such as Messrs. Geo. Law, Napier, McAlister, and Calvert, and also to the kindly advice and assistance rendered by the late Sir Alexander Kennedy. Mr. Law was the first chief assistant engineer to join a registered trade union and had started the break-up of the old caste system in supply undertakings. Then there was their chairman, Mr. W. S. Oswald, one of the very earliest of the E.P.E.A. workers, who had done as much as anyone to make the Association what it was.

Mr. W. J. Oswald (chairman), in reply, said that Mr. Healy's name must certainly be included among the list of pioneers. Speaking as one who had served for eleven years on the N.E.C. and who was now its "father," Mr. Oswald strongly urged the younger men to qualify by work in the Sections and Divisions to play a leading part in the Association's government. They would find the work hard but very interesting and would have the satisfaction of doing something for their profession and industry. He hoped that the Association's correspondence courses in tuition would be in operation before the end of the year.

At a later stage Mr. Oswald moved a vote of thanks to Mr. Cornett for his work in organising the dinner. This is the eleventh of the series, all arranged by Mr. Cornett. Between the speeches vocal and other items were given.

I.E.E. London Students' Dinner

The twenty-fourth annual dinner of the I.E.E. London Students' Section was held last Friday at the Florence Restaurant, London, W.

Mr. W. F. Walton (hon. secretary) proposing the toast of "The Institution," mentioned that 1931 was notable for three anniversaries: the diamond jubilee of the foundation of the I.E.E., the centenary of Faraday's principal discovery, and the wooden jubilee of the Charter. He regarded the latter as not the least important of them, in view of its effects on the future status of the profession.

Mr. C. C. Paterson, O.B.E. (president, I.E.E.), responding, said that the greatness of the Institution lay in its claim to put the interests of the industry first and the narrower interests of the professional electrical engineer second. He believed it would be necessary to adjust the qualifications required for membership in order to include physicists of the requisite standing. He then compared the qualifications of the engineer salesman with those of the general medical practitioner in spreading an understanding of the applications of electricity; and claimed that his work should not be regarded as in any way inferior to that of other engineers, if his technical qualifications were adequate.

G. J. Shaw (vice-chairman) proposed the health of "The Guests," referring to the help given to the Students' Section

by many of those present, including, in addition to the president, Mr. F. W. Crawter, Mr. Rollo Appleyard, Mr. Rowell and his staff, Mr. J. H. Reyner (editor of the Students' Journal), and the technical Press. Mr. E. A. Turner (London Students, Inst.C.E.) briefly replied.

Mr. F. W. Crawter proposed "The Students' Section." He had noticed the growth of a sound tendency among the students to ask what they could do for the I.E.E. rather than what they could get out of it.

Mr. L. S. Crutch (chairman) responded. He gave the disappointing information that whereas last year the average attendance at meetings had increased by 60 per cent., this advance had not been maintained during the current session. As the papers have been of a most interesting character, one may perhaps look for a possible cause in the depressing effect of many of the members being out of work. Mr. Crutch tentatively suggested, with a full appreciation of the difficulties involved, that the Institution should officially endeavour to rectify the situation to some extent. Interspersed with the speeches was an entertainment programme which included items rendered by courtesy.

International Illumination Congress

This Congress, to be held next September, will be attended by delegates from all parts of the world, and provides a special opportunity to show our visitors the technical aspects of lighting as practised in this country. During their stay in London it is anticipated that the visitors will make a river trip from Westminster to the Tower of London, and a special effort is therefore necessary for making the lighting of river frontages as spectacular as possible. Arrangements are in hand for floodlighting the Big Ben Tower of the Houses of Parliament, Somerset House, Buckingham Palace, and the Embankment by St. Thomas's Hospital. Consideration is also being given to providing illumination of some of the bridges.

It is therefore hoped that the owners of suitable sites in Central London (and especially the sites on either side of the river) will effectively illuminate their premises by means of floodlighting, signs, and other spectacular lighting that will be worthy examples of illumination practice in this country, and will also be of permanent value as features of the buildings themselves.

A communication from the secretary of the Congress has already been sent to the owners of buildings fronting the river between Westminster and the Tower Bridge, seeking their co-operation in this respect, and it is hoped that this will be followed up as closely as possible by all interested in this class of work.

Electric Haulage on the Rhine-Rhone Canal

In the "*E.T.Z*" of February 19th last a lengthy description is given of the electric haulage installation which has recently been completed by the A.E.G., of Berlin, on the Rhine-Rhone Canal, which has a length of about 90 miles. Barges of up to about 500 tons are now being hauled by means of 16-kW electric locomotives weighing about 6 tons, running on a 2-ft. track on the banks of the canal, the necessary power being supplied by an overhead conductor supported on iron masts, the line being fed from eight sub-stations, each comprising two 300-A 600-V mercury rectifiers. Altogether forty locomotives are in use.

Domestic Electrification in France

At a recent meeting in Paris of the Union des Syndicats d'Electricité a new committee, to be known as the Chauffage Electrique at Applications Domestiques de l'Electricité, was formed to deal with regulations and standardisation in respect of domestic uses of electricity.

Rural Electricity in France

At a recent meeting in Toulouse, France, organised by the Chamber of Commerce of that city and the Agricultural Propaganda Department of the Paris-Orleans Rly. Co., Mr. Louis Patrix, professor at the Ecole Supérieure de Genie Rural, read an instructive paper on "How to Use Electricity in Country Areas," in the course of which he described the various types of motors available for such use, and the different forms of drive, and the numerous purposes for which electricity can be used at and about farms; he also discussed the advantages and drawbacks of fixed and movable motors. The paper, with illustrations, has been recently published in book form by the Paris-Orleans Co. for distribution in the rural communities served by its railway system.

Institution of Engineers-in-Charge

Co-operation between the engineer and the chemist and the narrow margin of division between the work of the two was the theme which ran throughout the speeches at the 31st annual dinner of the Institution of Engineers-in-Charge held at the Holborn Restaurant, London, on March 27th.

Lt.-Col. E. Kitson Clark, M.A., president, Institution of Mechanical Engineers, in a speech in which was interwoven in delightful manner reminiscences of his workshop days, named the main three interests of the engineer-in-charge as personal relations, mechanical problems and responsibility. Anxiety was the gift which distinguished the human being from the brute beast, and engineers were carrying out one of the finest functions ever given to man to perform.

Mr. William Reavell, M.I.Mech.E., president of the Institution, who occupied the chair, quoted Charles Kingsley's "Madam How and Lady Why" in order to illustrate the fine difference between one class of engineer and another. The "how" was simple the "why" much more difficult. The real engineer was he who knew why a machine was made in a certain way.

Dr. E. F. Armstrong, F.R.S., said that the achievements of the world had been largely due to the efforts of the engineer. Future achievements would result from co-operation between the engineer and the chemist. The sun provided energy for crops from which all manner of materials on which modern life depended were produced; but the supplies were not inexhaustible, and materials would have to be made synthetically. The production of fertilisers from the nitrogen of the air was an example of what could be achieved by co-operation between the engineer and the chemist.

Mr. Loughnan St. L. Pendred, M.I.Mech.E., past president of the Institution, maintained his excellent standard of after-dinner oratory, and between his witticisms he made a gesture to the chemist: "Come into the fold and be one of us."

Lt.-Col. J. D. K. Kedler, O.B.E., M.I.E.E., warmly welcomed the guests and friends, and said he would like to compel every young engineer to serve on a sea-going vessel as part of his training. The way in which one at sea had to get over difficulties with what little tools and materials were available was excellent experience.

Mr. J. Arthur Reavell, M.I.Mech.E., drew an amusing sketch of a perfect engineer who overcame all sorts of difficulties and represented the last word in efficiency, but, alas! he was seriously called to order on account of sulphur-laden fumes found around Lambeth Palace.

The Electrical Association for Women

On March 25th members of the North Staffs Branch listened to a very interesting talk on "The Grid and its Objects" by Mr. C. H. Yeaman, city electrical engineer, Stoke-on-Trent, who explained how the Electricity Commissioners, the Central Electricity Board, and the various Joint Electricity Authorities come into existence. He likened the grid to an electrical fund into which everybody paid and out of which everybody drew.

The second annual general meeting of the Bristol and District Branch was held on March 24th, when Mr. J. W. Beauchamp, district engineer, south-west area, Central Electricity Board, and Mr. H. Faraday Proctor, city electrical engineer, Bristol, spoke. The branch has now a total membership of 134.

Clocks, Electrically Driven or Controlled

Electric clocks have seldom been dealt with in a book devoted to that subject alone; the amount of matter, however, which can be found relating to them is astonishing, as the records of the Patent Office show. For ingenuity in mechanical devices, electric clock mechanism might almost be said to take the front place, although it is doubtful if such ingenuity is fully appreciated.

Mr. F. Hope-Jones in preparing his book "Electric Clocks" (N.A.G. Press, Ltd., London: Pp xv+261, 12s. 6d. net) must have found the task of selecting and putting together such matter as exists a difficult one, but he has done his task well, indeed, no other man is so capable of dealing with the subject.

Although clocks actuated, controlled, &c., by electricity is the main subject of the book, mechanically driven clocks are largely discussed in reference to their defects, both in action and design; in regard to this, although the author's criticisms are mainly fair enough, he not infrequently goes a little beyond what may be considered as practical facts. The "free pendulum" is a favourite subject of his, but the correctness of his remarks about such pendulums may be questioned. Actually there can be no such thing as a "free pendulum," as all pendulums are subject to interferences of some kind, some great and some small, but all in some way or other restricting their freedom of swing. He is inclined to classify and condemn them in a rather unreasonable way; in other words, he is down upon clock makers because they still allow certain theoretical defects to be continued in use in modern clocks, as if these defects were of vital importance. The facts are that, although the defects in question exist, yet they are not eliminated in the design, for the reason that to do so would considerably complicate matters and result in no practical advantage.

Take the Westminster clock, for example—a remarkably correct timekeeper. Designed by Lord Grimthorpe, it was when made an immense advance on what had hitherto been done and it is still practically a standard pattern, so satisfactory has been its performance; yet its design contains many bad theoretical defects which, according to Mr. Hope-Jones's arguments, should condemn it (see page 162). Remove all these defects and what would in practice be actually gained?

When the question is one of "highest precision," as in the case of astronomical clocks, it is a different matter, and here a knowledge and the removal, of theoretical defects become of the highest importance, and Mr. Jones's analyses of these are of great value.

Unusual Cause of a Shut-down

A shut-down occurred a few days ago on an 11-kV overhead line of the Bournemouth and Poole Electricity Supply Co., Ltd., under somewhat unusual conditions. Mr. E. Llewellyn Ingram, chief engineer of the company, informs us that a brown squirrel climbed one of the poles and from one of the cross arms touched a conductor. This brought out the circuit breaker but did not kill the squirrel, which fell to the ground, ran squealing some distance, and was dispatched by a dog. The incident was witnessed by the owner of the dog who saw

the flash and the squirrel drop. The squirrel was scorched on both back paws and one fore paw but appeared to be otherwise externally uninjured by the discharge. The crossarm is of "wishbone" pattern and bird guards are considered unnecessary.

Tramways, Light Railways and Transport Association

The annual congress of the Tramways, Light Railways and Transport Association is to be held this year at Margate on May 28th and 29th.

A New Type of Neon Lamp

The development of a new type of neon lamp which, it is claimed, uses only half the energy required by present incandescent filament bulbs is reported in *Science*. The lamp referred to radiates light that is either white or has approximately the same wavelength as sunlight, and can be connected to an ordinary low-voltage a.c. supply. Glass tubes which can be made in any length from several inches to several feet, containing the rare gases of the atmosphere—helium, neon, argon, krypton and xenon—are the most conspicuous elements of the new unit. The initial cost of the new lamps will probably be higher than that of types now in use, but when the saving in power consumption is considered the cost over a considerable period of time is expected to be less than that of present methods of electrical illumination.

The new tubes distribute light evenly and have a soft non-glaring quality. It is possible to look directly into the exposed tubes for several minutes and turn immediately to read fine print, without undue eyestrain. They do not require heavy diffusing glass.

An automatic starting apparatus has been developed which will light the tube seven seconds after the switch is turned. Electrodes for the conduction of small currents and a ballast coil, which largely determines the power consumption and illuminating strength of the units, have been designed. Starting apparatus and a ballast coil are required with each lamp, but they are small and inconspicuous.

The Batti-Wallahs' Society

At the annual general meeting held on March 25th Mr. J. S. Highfield was elected President of the Society for the ensuing year. The other officers were re-elected, namely: Hon. secretary and treasurer, Mr. M. Whitgift. Committee, Messrs. A. E. Apps, G. M. B. Hilton, H. S. Jacob, W. E. Lang, H. S. May, and A. E. Mohring. In future the entrance fee will be £3 3s. (one half to be allotted to charity). There will be a luncheon at the Hotel Metropole on Wednesday, April 22nd, at 12.30 for 1 p.m. sharp, at which Sir Wm. H. Bragg, K.B.E., M.A., D.Sc., F.R.S., will deliver an address.

Report on the Patents and Designs Acts

The Report of the Departmental Committee on the Patents and Designs Acts and practice of the Patent Office, the appointment of which, under the chairmanship of the Rt. Hon. Sir Chas. Sargant, by the Board of Trade, was announced on May 22nd, 1929, was published on March 31st, (Cmd. 3829), and copies are obtainable from His Majesty's Stationery Office, or through any bookseller, price 1s. 6d. The minutes of evidence taken before the Committee will be published in the course of the next few weeks.

The Report is divided into three parts (1) patents (2) designs, and (3) general, and contains a summary of the Committee's main recommendations.

The Committee's findings and recommendations. The Committee finds no general demand for any alteration of the basic principles underlying the existing law in this country in relation either to patents or to designs, but recommends a large number of amendments in the Acts, some of which they regard as important and such as to justify early legislation.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. Henry Walker, chairman of Waygood-Otis, Ltd., and a director of many other companies, attained his eightieth birthday this week.

Mr. J. S. Highfield was on March 25th elected president of the Batti-Wallahs' Society for the ensuing year.

At the annual meeting of the South-West Area, E.D.A., **Mr. H. S. Ellis** (West Gloucester Power Co.) was elected chairman, **Mr. J. W. Spark** (city electrical engineer, Bath) vice-chairman, and **Mr. E. C. Willis** (Bristol Electricity Department) hon. secretary.

At the offices of the Lancashire Electric Power Co., in Manchester, on March 24th, **Mr. C. D. Taite,** the manager, on behalf of the chief officials of the company, presented a piece of silver plate to **Dr. H. F. Parshall,** M.Inst.C.E., upon his retirement from the position of chairman of the company, which he had held from 1908.

Mr. H. O. Chalkley, C.B.E., Commercial Counsellor at Buenos Aires, has been appointed Commercial Counsellor at Washington in succession to **Sir J. J. Broderick,** K.B.E. **Mr. S. G. Irving,** Commercial Secretary at Rio de Janeiro, will take Mr. Chalkley's place in Buenos Aires. The changes will be made some time in May.

Mr. R. B. Emerson, chairman of the Electrical Contractors' Section of the Southend Chamber of Trade, was presented with a case of cutlery, as an appreciation of his services, at the Section's first supper and ball on March 25th.

Mr. G. H. Cox having retired, **Mr. G. W. Malcolm** has been appointed chairman of the board of the Mersey Power Co., Ltd., and **Mr. J. P. Jackson** has been elected a director.

Obituary

Mr. J. C. Peache.—We learn with regret of the death, at the age of 79, of Mr. James Courthope Peache, who retired from the position of chairman of Willans & Robinson, Ltd., in 1914. Mr. Peache received his engineering training at the Crewe works of the London & North-Western Railway Co., and afterwards became assistant to the manager of the works. He joined the firm of Woodhouse & Rawson in 1881, and three or four years later went to Willans & Robinson, Ltd., with whom he remained until 1892 when he took an appointment with Davey, Paxman & Co. In 1904 he returned to Willans and Robinson, Ltd., as managing director, becoming chairman in 1912. Mr. Peache was the designer of the engine which bears his name and he was a member of the Institutions of Civil and Mechanical Engineers.

Mr. K. H. W. Hunter.—We regret to announce the death of Mr. Kenneth H. W. Hunter, B.Sc., who passed away on March 22nd, in Calcutta, after an operation for appendicitis. Mr. Hunter, who was a director and the assistant general manager of A.E.I. (India), Ltd., had been closely allied with the activities of the British Thomson-Houston Co. in India since 1919. He was born in 1889, and was educated at Burton-on-Trent Grammar School, from which he gained a scholarship which took him to Birmingham University, where, in 1913, he obtained the B.Sc. degree in mechanical and electrical engineering. After completing his University training he entered the service of the B.T.-H. Company in 1913, first in the test department and works, and subsequently in the engineering and export departments. In 1919 he joined the British Thomson-Houston Co. (India), Ltd., and in 1921 became manager of the Cawnpore office. In 1924 he was appointed manager of the head office in Calcutta and assistant general manager for the whole of the company's Indian business. For some years he was a director of the company. On the formation of Associated Electrical Industries (India), Ltd., at the beginning of this year, Mr. Hunter continued as manager of the Calcutta office, and was appointed a director of the new company. Mr. Hunter was a founder associate member of the Institution of Engineers, India. He had an extremely pleasing personality, making him very popular with everyone with whom he came in contact, and was keenly interested in golf and tennis. The sympathy of all connected with the British Thomson-Houston Co. will go out to Mrs. Hunter and her two little daughters in their bereavement.

The late Mr. K. H. W. Hunter

Mr. W. M. Westwood.—The death occurred recently at Perth of Mr. William McPherson Westwood, who with his father founded one of the first firms to undertake the manufacture of electrical apparatus in Scotland. Mr. Westwood carried out many important Scottish electrical installations.

Wills.—The late **Sir Herbert Lewis,** K.B.E., Cardiff, partner in Messrs. Lewis & Fletcher, electrical engineers, left £3,289, net personalty £1,013.

The late **Sir William Bull,** who was a director of Siemens Bros. & Co., Ltd., and Caxton Electric Developments, Ltd., left estate valued at £30,856 gross (£22,068 net personalty).

Mr. H. W. Woods, the late managing director of the Thames Electrical Co., Ltd., Surbiton, left £12,691 (£1,865 net personalty).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Alfred G. Mason & Collins, Ltd.—Private company. Registered March 21st. Capital, £2,000 in £1 shares. Objects: To carry on the business of electrical and radio wholesalers as formerly carried on by A. G. Mason and C. H. Collins, at 19, Percy Circus, King's Cross. The directors are: A. G. Mason, "Kimscott," 19, Grove Gardens, Teddington, and C. H. Collins, 13, Woodside Park Road, North Finchley, N.12, merchants. Secretary: W. C. C. Smith. Registered office: Capel House, 54, New Broad Street, E.C.

Heard & Short, Ltd.—Private company. Registered March 23rd. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in batteries and wireless receiving apparatus, electrical and mechanical engineers, &c. The subscribers (each with one share) are: H. C. Wisenden, 15, Park Ridings, Hornsey, N.8; A. Wilson, 62 Myddelton Square, E.C.1. Solicitors: Zeffert & Heard, 17, Coleman Street, E.C.2.

F. Beardmore & Co., Ltd.—Private company. Registered March 24th. Capital, £500 in £1 shares. Objects: To acquire the business of a contractor, electrical engineer, &c., carried on by Mrs. H. Beardmore, of 21, Blackfriars Street, Salford, Lancs., as "F. Beardmore." The first directors are: Mrs. H. Beardmore (permanent chairman) and E. A. Beardmore, Blankney House, Worsley Road, Winton, near Manchester, electrician; J. R. Thornton, Sunningdale, Laurel Road, St. Helens, Lancs., manufacturer. Qualification: One share. Registered office: 21a, Blackfriars Street, Salford.

Synchronised Electric Clocks, Ltd.—Private company. Registered March 26th. Capital, £1,000 in £1 shares. Objects: To carry on in Great Britain or elsewhere the business of manufacturers of and dealers in watches and clocks and time-pieces of all kinds, electrical, scientific and surgical instruments and parts thereof, &c. The subscribers (each with one share) are: G. Conrad, 103, Phyllis Avenue, New Malden, Surrey; E. G. White, 50, Hillside Road, S.W.2. Solicitors: Clifford-Turner, Hopton & Lawrence, 81/7, Gresham Street, E.C.2.

Wilkinsons (London), Ltd.—Private company. Registered March 25th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical and general engineers, manufacturers and repairers of and dealers in all kinds of machinery parts, tools and accessories, especially woodworking and electrical machinery, &c. The permanent directors are:—E. F. Howe (managing director) and Dorothy M. Howe, "Mornonih," Priests Lane, Brentwood; R. Howe, Mackery End, Hutton, Essex. Registered office: 43, Durant Street, Bethnal Green, E.2.

Catford Radio, Ltd.—Private company. Registered March 26th. Capital, £100 in £1 shares. Objects: To carry on the business of radio engineers, gramophone manufacturers, dealers in radio sets, &c. The subscribers (each with one share) are:—C. H. Bennett, High Holborn House, W.C.1; R. S. Wright, 65, Vernon Road, Seven Kings. C. H. Bennett is the first director. Registered office: 111b, Rushey Green, Catford.

Tye & Co., Ltd.—Private company. Registered March 27th. Capital, £1,000 in £1 shares. Objects: To carry on business as wireless and electrical engineers, manufacturers of wireless equipment and accessories, &c. The first directors are: H. Tye (chairman and life director) and Mrs. J. F. Tye, 442, Hertford Road, Lower Edmonton, N.9. Solicitors, Rexworthy, Barnard & Bonser, 83, Cannon Street, E.C.4.

City Electric Wiring Co., Ltd.—Private company. Registered March 25th. Capital, £500 in £1 shares. Objects: To acquire the business of an electrical engineer carried on by H. Radcliffe at 51, Islington Row, Birmingham. The directors are:—R. J. Stubington, 54, Charlotte Road, Edgbaston, Birmingham; P. Spence-Taylor, 50, Wordsworth Road, Birmingham. Registered office: 51, Islington Row, Birmingham.

Howard Butler, Ltd.—Private company. Registered March 28th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of, and designers of electrical and other scientific instruments, appliances, tools, &c., general engineers and engineers' agents, mechanical and electrical engineers, &c. The directors are: H. Butler (managing director), "Colwall," Four Oaks, Warwickshire, electrical instrument manufacturer; C. H. Whittle, 25, Goldsmith Road, Friern Barnet, N.11 (director, D. M. Henderson & Co., Ltd.). Registered office: Crown Works, Lincoln Road, Walsall.

Gresley Radio, Ltd.—Private company. Registered March 25th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for, and dealers in, electrical and other instruments, appliances and supplies connected with wireless, &c. The first directors are: S. A. Garnett, E. A. Garnett, and Pollie Garnett, all of Hope Bank, Kersal Bar, Salford (all permanent). Registered office: 36, King Street, Manchester.

Borolite Signs, Ltd.—Private company. Registered March 26th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in all kinds of signs, and to acquire the trade mark "Borolite." The directors are:—Sir Andrew Lewis, LL.D., 11, Queen's Road, Aberdeen (director of North-Eastern Welding Co., Ltd.); W. W. Leith, 35, Lavender Vale, Wallington; J. F. Proctor, 27, Milton Road, Wallington (director of Sure Arc Electro Co., Ltd.); A. Proctor, 54, Vallance Road, N.22; W. F. Proctor, 16, Bonaccord Terrace, Aberdeen (director of North-Eastern Welding Co., Ltd.). Registered office: 63, Crutched Friars, E.C.

Nelco, Ltd.—Private company. Registered March 28th. Capital, £6,000 in £1 shares. Objects: To carry on the business of engineers, producers and assemblers of, and dealers in, electrical motors, dynamos, instruments, and other apparatus, &c. The directors are: L. Murphy, Maesmor, Horsley, Surrey; G. N. White, Elder Lodge, Cookham Road, Maidenhead; E. T. Cook, 91, Wellington Street, Slough. Registered office: 15, Caroline Street, W.C.2.

Official Returns of Electrical Companies

Norwood Radio, Ltd.—Debenture dated March 16th, 1931, to secure £280, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. W. D. Burbour, 366, Brixton Road, S.W.2.

Bloomsbury Wireless Co., Ltd.—Debenture dated March 4th, 1931, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. N. Weinbaum, 9, Old North Street, W.C.1.

Aldwych Electrical, Ltd. (formerly H. A. C. (Electrical) Works, Ltd.).—M. D. Booth, 40/3, Norfolk Street, W.C.2, was appointed receiver and manager on March 17th, 1931, under powers contained in debenture dated February 27th, 1931.

Burt, Escare & Denelle, Ltd.—Capital, £40,000 in 15,000 preference and 25,000 ordinary shares of £1. Return dated November 13th, 1930. 15,000 preference and 22,732 ordinary shares taken up. £37,732 paid. Mortgages and charges £5,000.

Electric Services (Liverpool), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1930 (filed February 28th, 1931). 152 shares taken up. £152 paid. Mortgages and charges, nil.

Zenith Electric Co., Ltd.—Capital, £26,250 in 25,000 ordinary shares of £1 and 25,000 deferred shares of 1s. each. Return dated December 9th, 1930. 25,000 ordinary and 23,334 deferred shares taken up. £5,563 paid on 5,563 ordinary shares. £20,603 14s. considered as paid on 19,437 ordinary and 23,334 deferred shares. Mortgages and charges, nil.

Electrical and Radio Products, Ltd.—Issue on March 13th, 1931, of £1,000 debentures, part of a series already registered.

J. Segal, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1930. 990 shares taken up. £10 paid. £980 considered as paid. Mortgages and charges, nil.

Wakelin's Wireless Co., Ltd.—Capital, £2,500 in 1,250 preference and 1,250 ordinary shares of £1 each. Return dated December 1st, 1930. 135 ordinary shares taken up. £102 paid. £33 considered as paid. Mortgages and charges, £595 2s. 6d.

Victoria Garage and Electrical Co., Ltd.—H. G. M. Wilson, Grosvenor Chambers, Queen's Road, Coventry, was appointed receiver on March 20th, 1931, under powers contained in debenture dated September 30th, 1930.

Cattley Accumulator Co., Ltd.—Capital, £5,000 in £1 shares Return dated December 30th, 1930. 2,850 shares taken up. £1,900 paid. £950 considered as paid. Mortgages and charges, nil.

R. Falshaw, Ltd.—Capital, £5,000 in £1 shares. Return dated December 29th, 1930. All shares taken up. £2 paid. £4,998 considered as paid. Mortgages and charges, nil.

Cablon, Ltd.—Capital, £2,000 in £1 shares. Return dated December 4th, 1930. All shares taken up. £201 16s. paid (being £1 per share on 2 shares and 2s. per share on 1,998 shares). Mortgages and charges, nil.

Ernest Jones (Bradford), Ltd.—Capital, £3,000 in £1 shares Return dated January 12th, 1931. 1,153 shares taken up £1,153 paid. Mortgages and charges, nil.

Matthews Electric Signs, Ltd.—Capital, £2,000 in £1 shares. Return dated December 24th, 1930. 1,512 shares taken up £909 10s. paid (being £1 per share on 2 and 15s. per share on 1,210 shares). £300 considered as paid on 300 shares. Mortgages and charges, nil.

Read & Morris, Ltd.—Capital, £2,000 in 1,940 shares of £1 and 1,200 shares of 1s. each. Return dated November 7th 1930. 1,200 1s. shares taken up. £30 paid. £30 considered as paid. Mortgages and charges, nil.

Mutter, Sanders & Co., Ltd.—Debenture dated March 16th, 1931, to secure £250, charged on the company's property, present and future, including uncalled capital. Holder: T. H Mutter, 19, Colchester Avenue, Cardiff.

Peacehaven Electric Light and Power Co., Ltd.—Issue on March 12th, 1931, of £5,720 debentures, part of series already registered.

Shrosbery Bakewell & Co., Ltd.—Particulars filed of £800 debentures authorised February 3rd, 1931, charged on the company's undertaking and property, present and future, including uncalled capital and goodwill, the whole amount being now issued.

Radio Company of Great Britain, Ltd.—Capital, £100 in £1 shares. Return dated January 7th, 1931. All shares taken up. £100 paid. Mortgages and charges, nil.

William J. Hook & Co., Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated December 20th, 1930. 400 preference and 3 ordinary shares taken up. £403 paid. Mortgages and charges, nil.

Ferrow Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1930. Two shares taken up. £2 paid. Mortgages and charges, nil.

Implitico, Ltd.—Capital, £3,000 in £1 shares. Return dated December 30th, 1930. All shares taken up. £3,000 paid. Mortgages and charges, nil.

Davies, Kent & Stewart, Ltd.—Capital, £3,500 in 2,500 preference and 1,000 ordinary shares of £1 each. Return dated December 28th, 1930. 1,974 preference and 1,000 ordinary shares taken up. £2,974 considered as paid. Mortgages and charges, £1,050.

Nefa Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 5th, 1931. 999 shares taken up. £999 paid. Mortgages and charges, £500.

City Notes

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The accounts of this company were abstracted in our issue of March 20th and the annual meeting was held last week, Mr. R. P. Sloan (chairman), who presided, said in the course of his speech that as the result of an inquiry held by the Electricity Commissioners in December last into the company's charges, the Minister of Transport in June last gave his decision in which he stated that he had decided not to make an order, but considered that the company and certain other local authorities should review their tariffs with a view to modification if the satisfactory results of the past year's working were maintained. While the Minister's decision in no way bound the companies to take any action, the directors had decided to make certain substantial reductions in the prices for lighting and domestic supplies. These reductions had already been announced. The Newcastle Corporation had the right in July, 1932, to purchase the company's undertaking, but had decided, provided they agreed to proceed with the change-over of the system of supply in the city from d.c. to a.c., and subject to a satisfactory agreement being entered into, to postpone this right until some years later. Within that time it was anticipated that both the change-over and the standardisation of frequency within the city would have been completed. The company was prepared, on these conditions, to proceed with the work. The directors had decided to promote a Bill for the amalgamation of the company and its subsidiaries in the forthcoming autumn session of Parliament. The amalgamation affected eight companies—including the Newcastle company. Apart from this company there were the following:—County of Durham Electrical Power Distribution Co., Ltd., Houghton-le-Spring & District Electric Lighting Co., Ltd., Tees Power Station Co., Ltd., Cleveland and Durham Electric Power, Ltd., County of Durham Electric Power Supply Co., Cleveland & Durham County Electric Power Co., and the Northern Counties Electricity Supply Co., Ltd. A "Wharncliffe meeting" would be held in due course to obtain shareholders' approval to the promotion of the Bill, and the whole transaction should be completed before the end of 1932. The work in connection with the standardisation of frequency on the North-East Coast was well in hand, orders for plant and apparatus having already been placed by the company amounting to approximately £1,650,000. Apart from the reduction caused by the closing down of the Tyneside works controlled by Imperial Chemical Industries, and their transference to Billingham, their output showed an increase. Regarding the future, the most encouraging feature was the continued development of their lighting and domestic business. The report and accounts were adopted.

Telegraph Construction & Maintenance Co., Ltd.

The accounts of this company were abstracted in our last issue, and the annual meeting was held on March 26th, the Earl of Selborne (chairman) presiding. In the course of his speech the chairman said that the general industrial and financial position throughout the world in 1930 was one of severe depression and worse than in the two preceding years. The telegraph traffic returns, which indicated the state of trade, had shown a big decline for all operating companies, and the reduction of traffic had reacted unfavourably upon orders for the manufacture of submarine cable, which was still the most reliable means of long-distance transoceanic communication. In the year under review both their factories and their ships were kept fairly busy, and they manufactured about 80 per cent. of all the submarine cable required throughout the world. The work, however, had to be taken at very low prices to encourage the placing of orders, and in consequence this trading had been carried on at a loss. The financial position of the company was strong, and they were well up-to-date both as regarded their factories and ships. The competition of wireless had affected orders for cable, but the fact that the American Telephone & Telegraph Co. was projecting a telephone cable across the Atlantic in order to provide a 24-hour telephone service, which was not possible with wireless, was a significant testimony to the reliability and growing importance of the high-speed loaded type of cable as a potent factor in communications. On the success of this scheme would, to some extent, depend the type of future submarine cables. During the year many cable projects had been estimated for, but orders had been held up for various reasons. The Selborne Plantation had now practically recovered from the effects of the floods of a few years ago, and if the demand for gutta-percha continued the future value of the estate might well be proportionate to the falling-off of supplies of good quality mill gutta-percha from the jungles. To meet the present conditions they were doing all they could to economise in every possible way, and an all-round reduction of 10 per cent. had been made in the remuneration of the directors and staff. This reduction would take place from the end of March. The report and accounts were adopted.

Shropshire, Worcestershire & Staffordshire Electric Power Co.

The annual meeting was held on March 25th, Mr. F. Massingberd Rogers (chairman) presiding. In presenting the report and accounts (ELEC. REV., March 13th, p. 480), the chairman, after referring to the loss sustained by the company in the death of Mr. Emile Garcke, said that compared with the preceding year, there was an increase of 9.7 per cent. in the electrical energy generated, and an increase of 10.28 per cent. in the amount sold, while the number of consumers increased by 39.43 per cent. During the past year they had obtained Special Orders authorising them to supply electricity in the rural district of Newent, and the borough and part of the rural district of Abergavenny. They had taken over eight other small unauthorised undertakings in different parts of the area, and their area of supply was now approximately 3,700 sq. miles. To provide a sufficient supply for the rapidly increasing business, additional plant of 40,000 h.p. was being installed at the Stourport power station, and when this installation was complete the total h.p. at Stourport would be over 100,000. Arrangements had been made under the Development (Loan, Guarantees and Grants) Act, 1929, for a contribution by the Treasury for a period of five years, of interest at the rate of 2¼ per cent. per annum from the date of expenditure, on capital for new transmission lines amounting to over £600,000. As part of their scheme for development, prices had been reduced where load and circumstances had justified the action, and they had introduced a hire-purchase system with a considerable measure of success. An agricultural research department had been formed to stimulate further the use of electricity on farms, dairies and other agricultural activities. Since the close of the year they had acquired a controlling interest in the South Wales Electrical Power Distribution Co. The organisation of the two companies was being co-ordinated to ensure the maximum efficiency in generation and distribution over the wide area now controlled by the company. The development of this area would require more capital, and an application for a Special Order to increase the capital and borrowing powers of the company was recently made. The report and accounts were adopted.

City of London Electric Lighting Co., Ltd.

The annual meeting was held on March 25th. Mr. J. B. Braithwaite (chairman) presided, and in presenting the report and accounts (ELEC. REV., March 13th, p. 481) said that the electrical energy sold during the year amounted to 94,538,223 kWh, an increase of about 5¼ millions as compared with the previous year. There had been a further fall in the price in all classes of supply and the average price obtained per kWh had decreased from 2.1d. to 2.02d. The company's share of the consumers' benefit was £67,084, which had been transferred to a special reserve, raising the total of that reserve to £310,842. They would be able to add two more annual quotas to that before they had to decide on further capitalisation in preparation for the new standard price which would be fixed in 1933. They were making preparations, therefore, to capitalise a further £400,000, which would allow of a distribution of one new fully-paid ordinary share for each three shares now held. In 1933 the standard ordinary dividend would be reduced to 7 per cent.; but they would have little difficulty in obtaining the additional amount required to maintain the dividend at the present figure. They had entered into a contract with the Southwark Borough Council to supply it in bulk, and they hoped the supply would commence next autumn, but the company would not feel much benefit until the Council was in a position to abandon its generating station. The report and accounts were adopted and a resolution was passed increasing the capital of the company to £2,400,000 by the creation of 400,000 additional ordinary shares of £1 each.

Mersey Power Co., Ltd.

Presiding at the annual meeting on March 24th, Mr. G. H. Cox (chairman) in presenting the report and accounts said in each of the years 1929 and 1930 the amount charged in the accounts in respect of rates was multiplied more than fivefold compared with 1928, the total increment in the two years representing nearly 5 per cent. on the ordinary share capital. The total sales of electricity were 71,504,000 kWh, a decline of 9 per cent. which was entirely in bulk sales, retail sales showing a small increase. Several new rural districts were connected up during the year and applications for supplies, largely to domestic consumers, were satisfactory. The number of new consumers connected was 909, bringing the total to date to 6,726. Fifteen new sub-stations were added, making a total of 82, and 30 miles of main supply cables were laid, bringing the total to 270 miles. The report and accounts were adopted.

South London Electric Supply Corporation, Ltd.

The annual meeting was held on March 24th, Lt-Col. Sir Frederick Hall presiding in the absence through ill-health of Sir Harry Renwick (chairman). In presenting the report and accounts (ELEC. REV., March 20th, p. 522) the chairman said they had made substantial reductions in the rates to consumers as from January 1st, 1930, and the electrical energy sold showed a gratifying increase of 7,103,329 kWh, which represented a rise of more than 31 per cent. The capital expenditure now amounted to £888,546, and the net expenditure during the year amounted to £84,526. The principal expenditure was in connection with additions to, and reinforcements of, existing mains. In the course of this work they were standardising their method of distribution. The report and accounts were adopted.

Canada Power & Paper Corporation

The Montreal correspondent of *The Times* reports that at the annual meeting held on March 25th, Mr. H. J. Grundy, the president, admitted that the corporation had not earned during the first two months of this year interest on its mortgage bonds, and that it was facing a crisis which made financial reorganisation imperative. He promised that a reorganisation plan would be laid before the shareholders for approval, and apparently it will be worked by the security holders' protective committee, headed by the Hon. Charles Dunning. He did not favour any drastic reduction of capital, but some scaling down was necessary to keep interest charges within range of the company's earning power.

Brompton & Kensington Electricity Supply Co., Ltd.

The report for the year ended December 31st last shows a balance on net revenue account of £44,266, to which is added £6,485 brought in, making £50,751. A final ordinary dividend of 10.473d. per share is recommended, making the standard dividend for the year, and it is proposed to transfer to special reserve the ordinary shareholders' proportion of the consumers' benefit (£13,743), and to appropriate £3,103 to co-partners, leaving £1,604 to be carried forward. The connections increased from 28,506 to 31,672 kW, and the sales of electricity from 10,392,914 to 11,941,881 kWh. Meeting: April 9th.

G. D. Peters & Co., Ltd.

The gross profit for 1930 was £17,637, as against £8,834 in the preceding year, but after providing £11,121 (against nil) for depreciation and £5,886 (£6,245) for interest, the net profit was £630 (against £1,632, when £957 was reserved for income-tax). No dividend is recommended and the amount carried forward is increased to £15,254. Towards the end of the year G. D. Peters (India) Ltd., was formed as subsidiary through which the company's business in India, Burma and Ceylon has been conducted from January 1st last.

British Engine, Boiler & Electrical Insurance Co.

The accounts for the year ended December 31st last show a balance of £36,375 on revenue account, to which is added interest and rents amounting to £25,344 and a balance of £20,139 brought forward. After meeting directors' fees, &c., and transferring £20,428 to the pension fund and £15,000 to the contingency fund. The final dividend is 15s. per share, making 30s. per share for the year.

Pinchin, Johnson & Co., Ltd.

Presiding at the annual meeting on March 26th, Mr. E. Robson (chairman) said they had recently acquired a majority holding in a paint and varnish manufacturing undertaking in Buenos Aires. This development had been essential in order to preserve and extend their business in South America. The directors had under consideration proposals for extending the company's business. The report and accounts were adopted.

Morgan Crucible Co., Ltd.

The accounts for 1930 show a net profit of £220,206. The directors recommend a final dividend of 4½d. per share on the deferred ordinary shares, making 1s. 1½d. per share for the year, and the capitalisation of 7 per cent. obligations amounting to £67,437, which are to be retained for employment in the business. The carry forward is £561, as against £782 brought in.

Torquay Tramways Co., Ltd.

Presiding at the general meeting on March 25th, Mr. H. T. Barnett (chairman) in the course of his speech, referred to the rejection by the House of Commons of the company's Trolley Vehicle Bill and expressed his dissatisfaction at the decision. They were still satisfied, he said, that the trolley vehicle system was the right system to be installed at Torquay.

Erinoid, Ltd.

The report for the half-year to January 31st states that the profits have been maintained at practically the same figure as in the corresponding period of the preceding year. A dividend at the rate of 5 per cent., less tax, is recommended out of the profits to July 31st last.

Parker, Winder & Achurch, Ltd.

The net profit for 1930 was £2,342. It is proposed to pay a final ordinary dividend of 3½ per cent., making 6 per cent. for the year (against 7½ per cent.), and to carry forward £9,255 (against £11,702).

International Hydro-Electric System

The directors have declared the usual stock dividend of 1/50th of a share of class "A" stock. Shareholders will have the option of taking cash in lieu of stock at the rate of 50 cents per share.

Sun Electrical Co., Ltd.

The directors have declared an interim dividend of 5 per cent. on the ordinary shares. They state that business is being well maintained and that there was an increase in turnover in the first nine months of the current financial year. The recent issue of capital was successful and the whole of the 60,000 preference and 20,000 ordinary shares were purchased and paid in full by the Gresham Trust in February last.

Chelsea Electricity Supply Co.

A final dividend of 11.2d. per share has been declared on the ordinary shares, less tax (same).

International Telephone & Telegraph Corporation

The regular quarterly dividend has been declared on the no-par-value shares of 50 cents per share.

Northern Mexico Power & Development Co.

A dividend of 1¾ per cent. has been declared on the preference stock for the quarter ended March 31st.

Associated Telephone & Telegraph Co.

An additional dividend of 50 cents per share is announced on the class "A" stock.

Stocks and Shares

MONDAY EVENING.

STOCK Exchange markets wind up in very chastened mood the first quarter of the calendar year. Added to the unfavourable factors at home, there is now a definite break in American optimism. Although a few of the United States industries are showing expansion as compared with last year—electric power supply and construction being amongst this minority—the greater part of American trade is disappointing. The prices of stocks and shares reflect the failure of the hopes for an early revival in business. A fairly general fall in values, shaking Wall Street operators rather badly, led to sympathetic depression in our markets, already suffering from Budget fears, holiday influences, and poor company reports. The gilt-edged stocks are tolerably well-maintained.

London Transport Bill

Slight improvements after the recent falls in the prices of Underground Electric Railways shares and in Metropolitan District stock are something for which the holders should feel thankful in these days. The Minister of Transport has announced that the new Board, for which the London Passenger Transport Bill provides, will be composed primarily of business men, political controversy and influence being excluded from its management. He claimed elimination of wasteful competition as one of the features in favour of the Bill. Strong opposition to the latter will be brought to a head on the Tuesday in this week, when the London County Council is to be asked, by three of its own Committees, to present a petition against the Bill. The Stock Exchange market awaits with close attention the next steps in a matter that caused heaviness in the prices of stocks likely to be affected.

Tramways and Omnibus Prices

London United Tramways 4 per cent. debenture stock has parted from 2 points of its recent sharp rise. The price is 63¾, and the 5 per cent. preference shares (of £1 each) changed hands at half-a-crown last Friday. The debenture interest has been regularly met. London & Suburban Traction debenture stocks are also in receipt of their interest, but the 5 per cent. preference shares, quoted at 10s. 6d., have been out of the dividend list since March, 1924. The ordinary shares are quoted at a florin, and London United ordinary at ninepence. Metropolitan Electric Tramways ordinary changed hands last at 4s., and the 5 per cent. preference at 10s. The 5 per cent income debenture stock stands at a little over par.

Australian and Indian Issues

The grave turn given to Australian financial affairs by the threatened repudiation of her debts by New South Wales has cast a further cloud upon every kind of investment in that

Continent. Fortunately, the Federal Government has resolved to meet this week's dividends. Quotations tend to be nominal, but in the electric supply group, Adelaide 6 per cent., 5 per cent., and 6¼ per cent "C" preference stocks are all called 65 to 75. The last-named was dealt in at 66 a fortnight ago. The two other stocks have fallen 25 to 30 points since bargains were recorded in them a few months back. Kalgoorlie Electric ordinary and 6 per cent. income debenture are 7s. and 80, respectively. Melbourne Electric ordinary at 115 is 60 points lower than it was this time last year. The various Indian electrical issues remain fairly steady. Calcutta Supply ordinary hold their price at 38s. 9d.; the new shares are 6s. 6d. premium. Cawnpore ordinary are 25s. 9d. Delhi Electric ordinary keep at 30s. and Madras at 25s. Tata Power 7½ per cent. "B" debenture stock finds buyers at 101: the company's 4½ per cent. debenture is a Trade Facilities issue, and is a firm market at 99. Moving farther East, Burma Electric ordinary are 8s. 9d., and the 6 per cent. preference, 15s. There has been a little business recently in the former shares.

Canadian-American

Heavy falls in the prices of American and Canadian industrial issues are apparently due to the inability of New York market leaders to maintain price-levels against the weight of public selling in the States. The Wall Street market has approached perilously near to what has looked like demoralisation. Electricity stocks and shares resisted, better than most, the shrinking tendency, but losses are shown in various descriptions. Consolidated Gas & Electric of Baltimore is dull at 102, after marking down to 98¾. Canadian General Electric preference at 62¼, Calgary Power common at 149, Pennsylvania Water at 68½, and Shawinigan at 56, lean to the lower side. The big bull pools that have been supporting American-Canadian utilities are presumed to be conserving their resources. American Telephone & Telegraph is steady at 202: International Telephones, after being 38, went back to 36.

Cables and Wireless

The generally dull disposition of the Stock Exchange markets has made itself felt upon Cables & Wireless stocks, the 5½ per cent. preference receding to 66 and the "A" ordinary to 23. It has been possible, once again, to buy £100 of each class of stock for £100 money. A few bargains were done on this basis; dealers in the market made prices in what they call "the mixture." The "B" ordinary stock is 10s. lower at 12. The Anglo-American group shows no alteration. Marconi Marines continue at 2; the passing of the Cunard Company's dividend lends emphasis to the statement that shipping is now at an ebb lower than it has been within living memory.

South Americans

No relief has yet come to the weakness in Brazilian Traction shares. The price is flat at 23. The preference are about 90, having moved but little for two months past. Brazilian issues are losing the favour they recently obtained, the reaction being due to the downward tendency of the exchange. Rio Tramways 5 per cent. gold bonds, for the interest on which there still seems ample protection, keep firm at 101. The 5 per cent. mortgage bonds, with a coupon due on Wednesday in this week, are 88½ cum. dividend. Sao Paulo Tramway Light & Power 5 per cent. debenture—a perpetual stock—was done a few days ago at 82. Anglo-Argentine Tramways preference shares continue to feel the benefit of the Prince of Wales's Argentine visit, and the Buenos Aires Exhibition, but the 5 per cent. debenture stock has moved back to 40½, showing a fall of 2. The next interest-payment is due on June 1st. Amongst the Mexican descriptions, Light & Power common have lost 2 of their last week's gain of 10 points. On the other hand, Mexico Tramways 5 per cent. bonds are similarly higher at 51½.

Stock on Offer

No alterations of any importance have occurred amongst Home electricity supply shares. London Electrics are better again at 33s. 6d. County of London have eased to 47s. offered. A parcel of Metropolitan Electric ordinary is available at 40s. 9d. Probably the shares on offer are part of those given to Egham & Staines shareholders in payment for their company's business. A few thousand Scottish Power ordinary can be bought at 29s. 9d. cum. the 8 per cent. dividend lately declared. The yield is about £5 12s. on the money.

Of the gilt-edged stocks, Central Electricity 4½ per cent. debenture at 1 discount is equal to 94½ for the fully-paid scrip. London & Home Counties 4½ per cent. debenture stands at the same price, and London Power 5 per cent. debenture is a good market at the advanced figure of 102¼. North-West Midlands Joint Electricity 5 per cent. stock, 1950-1970, can be obtained at 102⅜ free of stamp duty.

Manufacturing and Miscellaneous

Associated Electrical Industries weakened to 22s., while G.E.C. ordinary held their ground at 46s. 3d. A line of £10,000 G.E.C. 5 per cent. mortgage debenture stock has come on offer at 100¾. The next interest-payment is due in September. On the 1929 profits, interest on this stock was covered more than six times. The Henley, Callender, Enfield, British Insulated group of shares is very quiet. Iron, steel and allied descriptions are equally uninteresting. Rubber has fallen to another record low level.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Approx. Dividend. 1929.	1930.	Price March 30 1931.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	3	—	5 0 0
Brompton Ordinary	1	8½	8½	28/6	—	4 18 3
Central Electricity 4½% Deb. ...	Stock	—	—	94½	—	4 15 3
Charing Cross Ordinary	1	8½	8½	29/6	—	4 15 0
Chelsea	1	8⅝	8⅝	28/-	—	5 0 0
City of London	1	10	10	37/6	—	5 6 8
Clyde Valley	1	8	8	33/9	—9d.	4 12 9
County of London	1	7	10	47/-	—1d.	4 5 0
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	48/-	—	4 11 7
Kensington Ordinary	1	8	8	29/-	—	4 16 7
Lancs. Light and Power	1	7½	7	24/-	—	5 16 8
London & Home Counties 4½% Deb.	Stock	—	—	94½	—	4 15 3
London Electric	1	8½	9	33/6	+6d.	5 9 1
Metropolitan	1	9	10	40/9	—	4 18 1
Midland Counties	1	6½	7	28/-	—	5 0 0
Mid. Elec. Power	1	15	8	31/3	—	5 2 5
Newcastle-on-Tyne Ordinary ...	1	6	6	28/3	—	5 6 8
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref. ...	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	28/6	—	4 18 3
Scottish Power	1	8	8	29/6	—	5 12 0
South London	1	8½	8½	28/-	—	5 0 0
Urban Ordinary	1	7	7	27/6	—	5 1 10
Westminster Ordinary	1	8½	8½	28/6	—	4 18 3
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	25/-	—	6 0 0
Yorkshire Elec.	1	8		32/6	—	4 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	77	—	5 4 0
Metropolitan	,,	4	3½	55½	—	6 6 2
do. District	,,	5	5	74½	+1	6 14
Underground Electric	£1	8	8	22/6	+6d.	7 2

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	108½	—	5 16 0
do. Def.	,,	1½	1½	26⅞	—	5 16 6
Automatic Telephone	1	12½	12½	37/6	—	6 13 4
Cables & Wireless 5½% Pref. ...	Stock	5½	5½	66	—1½	8 6 8
do. A 7½% Ord.	,,	Nil	—	23	—½	... ...
do. B Ord.	,,	Nil	—	12	—½	... ...
Globe Tel. and T. Ord.	10	10	—	19½	—	... ...
do. do. Pref.	10	6	6	10⅜	—	5 15 8
Great Northern Tel.	10	20	20	30½	—	6 12 4
Marconi-Marine	1	15	15	40/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	23	—	*5 1 0

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	—	1½	—	... ...
do. do. 2nd Pref. ...	5	6	—	15/-	—	... ...
do. do. 5% Deb. ...	Stock	5	5	40½	—2	12 6 10
British Electric Traction Def. Ord.	,,	5	5	1350	—	... ...
do. do. Pref. Ord.	,,	8	—	131½	—	6 1 0
Brazil Traction	100	8	—	23	—	... ...
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	97½	—	5 2 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	69½	—2	5 6 0
Mexico Trams, 5% Bonds ...	—	5	5	51½	+2	9 14 2
Mexican Light Common	100	Nil	Nil	66⅛	—2	... ...
do. 7% Pref.	100	7	7	79½	—2	8 8 0
do. 1st Bonds	—	5	5	79	—	6 6 7
Victoria Falls Ord.	1	15	15	58/-	—	5 3 5
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...

Manufacturing Companies.

	1928.	1929.			
Assoc. Elec. Ord.	1	6	6	22/-	—6d.	5 9 1
Babcock & Wilcox	1	13	15	59/-	—	*5 15 5
British Aluminium Ord.	1	10	10	30/-	—	6 9 0
British Insulated Ord.	1	15	15	3½	—	4 16 0
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3	—	5 0 0
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	1 1/16	—	7 1 2
do. 8% Pref.	1	8	8	28/-	—	5 14 5
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	94½	—	5 5 10
Electric Construction	1	5½	5	11/9	—	8 10 2
Enfield Cable Ord.	1	20	25	48	—	5 14 2
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	6/3	—	... ...
Ferranti Pref.	1	7	7	21/6	—	6 10 4
G.E.C. Pref.	1	6½	6½	25/6	—	5 2 0
do. Ord.	1	10	14	46/3	—	6 1 8
Henley	1	25	30	51½	—	5 5 5
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	5/-	—	... ...
Johnson & Phillips	1	10	10	36/9	—	5 8 10
Siemens Ord.	1	7½	7½	1⅛	—	7 1 2
Telegraph Construction	12	10	10	16½	—	... ...

*Dividends paid free of Income Tax.

The Economics of Manufacturing

Quantity Production Without Unduly Increased Investments

By A. W. WILLSMORE, F.R.Econ.S.

MANUFACTURERS are to-day giving serious attention to the possibility of reducing costs in order to preserve their profit margins, and one of the policies that the more progressive firms are pursuing is the examination of the question of economic ordering.

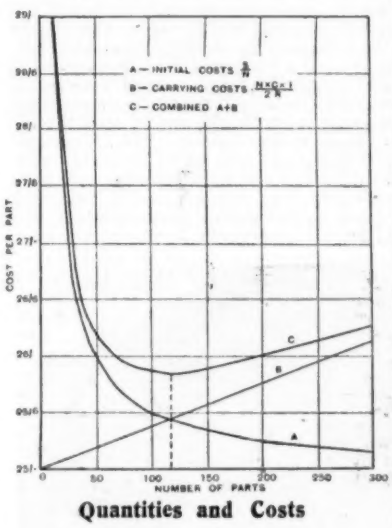
The object of these studies in the direction of machine runs and the economic quantity of parts to be ordered at one time, is to secure the full benefit from quantity production without increasing the investment beyond the point where the savings resulting from producing in large quantities at a time would be offset by increased investment charges for carrying large stocks. Three distinct sets of items are included in the cost of manufacture, *viz.*, unit cost, initial cost, and carrying cost. The unit cost represents the actual raw material used and the direct labour charge, and is therefore unaffected by the quantity of parts made at one time. Cost of production can, of course, be reduced through unit cost, either by obtaining cheaper raw material or by decreasing labour costs, by improvements in manufacturing methods, or the reduction of wages. Under any one set of conditions, however, the unit cost of an article must remain the same whatever the quantity produced. The other two sets of items constitute opposing variables and the problem is to find the point at which their combined total is a minimum.

The initial costs involved in the manufacture of an article, include the cost of setting up the machine and the cost of all of the associated clerical work involved in placing the order, selecting raw material, recording, and arranging for inspection. For any particular article, this group of costs represents appreciably the same total irrespective of the number of parts that are produced on the order, so that the larger the number of parts actually produced the smaller is the individual initial cost for each part. Unfortunately, however, this has a tendency to increase the manufacturing cost.

The group of items to which we have referred as carrying cost, includes interest on investment, insurance charges, stock losses and obsolescence, rental and maintenance of store-room space. It is apparent that the total of these carrying costs depends on the quantity of goods produced and the time for which they must remain in stock as governed by the rate of consumption. For instance, if we assume that the monthly rate of consumption is 100 and the quantity produced at each run is 200, the concern would have to run six orders during the year but the average quantity to be carried in stock would be 100, on the basis of 200 at the beginning of a two months' period and nil at the end. The firm could save on initial costs by producing the whole year's requirement of 1,200 at one run, but under these circumstances the average quantity in stock would be 600 with consequent increased carrying costs.

The accompanying curves show the cost per individual article on the basis of the quantity produced at each run. It will be noted that the initial cost decreases rapidly as the quantity produced at one time is increased, while the carrying cost increases in direct proportion to the quantity ordered. The problem is to find the point at which the combined initial and carrying costs, representing the sum of the two opposing groups, is a minimum. This, of course, represents the lowest point on the curve combining the two series, which, incidentally, is directly above the intersection of the two opposing series. Actually it is not practicable to determine economic quantities from such a curve, and special formulas must be developed to take into account such factors as the rate of consumption, the set-up cost, unit cost and carrying rate. Provided the principles behind the scheme are firmly understood, this should present no serious difficulty.

The economic ordering quantity can be determined with reasonable accuracy, however, by multiplying the set-up cost by twice the annual consumption, dividing the product by the unit cost (or prime factory cost) times the carrying cost per £ of investment, and taking the square root of the result. To illustrate this point, we may assume a hypothetical case where the rate of consumption is 400 per year, the factory cost £1.25 per unit, the set-up cost for each order with associated clerical work £2.5, and the carrying rate 12 per cent. per £ of investment. To determine the economic production quantity, we would proceed to multiply the set-up cost of £2.5 by twice the annual consumption, or twice 400. This would give us a figure of £2,000. The second step in the calculation would be to multiply the unit cost, £1.25 by the carrying rate, 12/100, thus obtaining a figure of £1.25 × 0.12, or £0.15. The third step would be to divide the result of the first calculation by the result of the second. This would give us £2,000 ÷ £0.15, representing 13,333, and the economic production quantity would be the square root of this figure, which is approximately 115. This means that under the conditions of this case the total unit cost would be a minimum if the article was made at the rate of 115 per order.



Quantities and Costs

It must be appreciated, of course, that the calculation above is only an approximation, as several theoretical points have been omitted from consideration. In the first place, it has been assumed that complete and immediate delivery is made to stock although actually this would probably not be so. Secondly, it has been assumed that machines are completely re-set for each order and that only one machine is set up for each operation, whereas in actual practice this is not always the case. Finally, the whole question of process investment has been left out of the question. If desirable, a formula could be developed to allow for these theoretical points. Such a formula, however, would be much too complicated for general use, and the simpler form may safely be used in spite of the theoretical objections, particularly as the errors introduced more or less offset one another, although in certain cases it may be necessary to develop special formulas to meet the particular needs of the company in question.

Some of the advantages that have actually been obtained from the establishment of economic production quantities include more production on fewer orders and with a smaller labour force, reductions in raw material inventories, increases in the turnover of finished goods, an increase in the application of mechanical handling of materials, greater supervision of production at reasonable cost, closer control of overhead, and improvements in cost-collection methods. The scheme of economic production quantities is not suggested as a panacea for all industrial ills, but experience has proved that if sufficiently careful consideration is given to its application very surprising economy can be effected.

Indian Electrical Development

A Survey of Activities in the Principal Cities

By R. L. ACLAND, M.I.E.E.

MY first view of India was from the deck of a steamer sailing into Bombay harbour one beautiful morning early in December last. We tied up at seven o'clock and through the avalanche of coolies that fell on the ship in search of a job, I was welcomed by my friends from the Bombay Electric Supply and Tramways Company. This company is a rupee concern controlled by Parsi directors, and it takes the whole of its supply from the Tata Hydro Electric Supply Co., Ltd., through its receiving station at Parel, Bombay. The showroom is on the ground floor at the head office, and consists of a main hall about 40 ft. square, surrounded by window rooms and smaller display spaces. It is lofty, and the interior is beautifully furnished and decorated. A pale golden light is diffused over the ceiling by special fittings, and refreshing breezes are produced by the white and gold fans revolving slowly overhead. Outside is the heat and glare of the eastern sun, so that the visitor is glad to delay his departure and meanwhile discuss matters electrical with the expert staff that is always in attendance. In every way the display of fittings and appliances here is absolutely up-to-date and comparable with the latest at home, or in America and the Continent. Separate spaces are devoted to the display of cooking, heating, washing, ironing, medical apparatus, refrigeration, vacuum cleaners, &c. A large, well-equipped testing department forms an important

The Bombay Company's Headquarters

part of the organisation, where, among a multitude of other things, all types of reflector fittings for indoor and outdoor use are tested by a special photometer and the makers' figures checked; as a result, some of the street-lighting effects are remarkably good. Wherever you go in Bombay, you are told what electricity can do for you; the slogan "Electricity is Best" appears on all the street section pillars; E.D.A. posters can be seen throughout the city; and all the company's lorries and tramcars help to spread the good news. The service department undertakes the repair of any class of electrical apparatus, which is thoroughly tested before being returned to the owner. The charge for this work is based on time and material plus a small percentage. Water heaters, *dhobi* irons, wardrobe heaters, electric signs and other things are being made or are in the experimental stage. Supplies are taken by the trade. The staff are prepared to give lectures at schools with the idea of impressing the young mind. The company already conducts examinations in practical electrical work at several colleges, and runs a series of lectures in English and vernacular for its own staff, which are well attended. The Bombay Company is undoubtedly doing valuable educational work from which the whole of India will benefit.

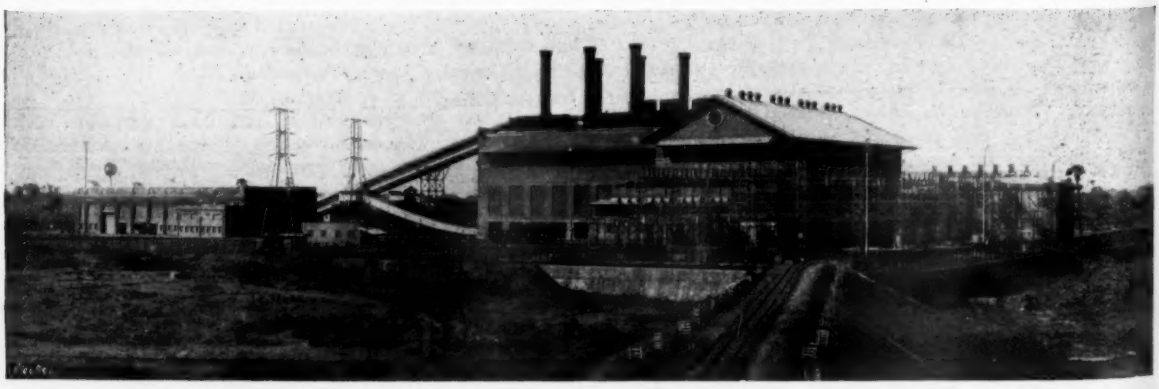
In 1926 the company's whole load was transferred to the Tata Company and the existing steam station was shut down; some of the old plant is doing useful work in other parts of India. The Tata Hydro-Electric Supply, and allied concerns have a total plant capacity of 183,000 kW, all the water for which is provided by the monsoon rainfall of some 200 in. stored in 46 sq. miles of lakes in the Western Ghats, where it falls. Triplicate 100,000-V lines run into Bombay some 45 miles to the west. Another notable plant in the Province is the 40,000-kW steam power station of the G.I.P. Railway at Chola for supplying the Bombay-Poona electrified line. At present only the Kalyan-Poona section is run, and when the existing contract with the power company expires then will be added the Kalyan-Igatpuri section.

A 26-hour run from Bombay brings one to Cawnpore, a big industrial city with a population, including the cantonment area, of nearly a quarter of a million, of whom, apart from the military, about 1,300 are Europeans. Cawnpore presents a splendid example of what British enterprise and capital can do for a big Indian city. The Cawnpore Electric Supply Corporation commenced operations at the old power station, Mall Road, at the end of 1906, and was one of the earliest to make a start in British India. Such was the progress made in the early years that the capacity of the old station (under 1,000 kW) soon proved too small, and in 1921 a big new station on the banks of the Ganges was laid down with 6,000 kW, afterwards extended by 12,000-kW, and quite recently a further 12,000-kW set has been installed. In the early days, in order to demonstrate the utility of the electric motor as compared with the oil engine, the supply company put down a small flour mill, driven by a 10-h.p. motor, at the works as a demonstration plant, and to-day there are hundreds of small motors connected to the mains, from 5 to 40 h.p., for sawing, pumping, sugar-cane crushing, rag-waste making, and a large number driving small flour mills. In addition to the many small industries run electrically, big cotton and oil mills take the whole of their power supply from the mains. Motors of all sizes, ceiling and table fans, and complete installations can be had on hire, or hire-purchase. The Indian is quick to assimilate new ideas and every encouragement and assistance is given him in Cawnpore to think electrically.

The 300-mile run north-west brought me to ancient Delhi that has figured largely in the history of India for many centuries, and where a strange mixture of ancient beauty and modern garishness forms a background for the intensive operations of the Delhi Electric Supply and Traction Co., Ltd., which supplies Old Delhi and cantonments. The company has a Diesel-engined station with a maximum load of 2,750 kW, which is linked up with the Government turbine station in New Delhi. In addition to lighting and fans there is a big load for street lighting, tramways, and small power users among the 300,000 or more inhabitants.

From Delhi a 900-mile journey south-east brought me down to Calcutta, with a population of nearly 1¾ millions, the centre of the Indian jute trade and headquarters of many great commercial undertakings. To be responsible for the electricity supply to such an area is an onerous duty, but in the hands of the Calcutta Electric Supply Corporation, Ltd., to whom an order for 10 or 1,000 kW supply is taken in the ordinary business routine, at rates satisfactory to all parties, the history has been one of continuous progress.

Howrah, a growing industrial area on the opposite (western) bank of the Hooghli to Calcutta, has overgrown the existing mains laid over the bridge, and a special cable tunnel is being constructed under the river opposite the southern station. Public supply was started in 1899 with a small d.c. station of 1,000-kW capacity and three others followed in different parts of the city. In 1910 a new central station at Cossipore on the Hooghli was commenced, and by 1915 the old generating stations had been replaced by sub-stations in different parts of



The 40,000-kW Station of the G.I.P. Railway, Chola, near Bombay

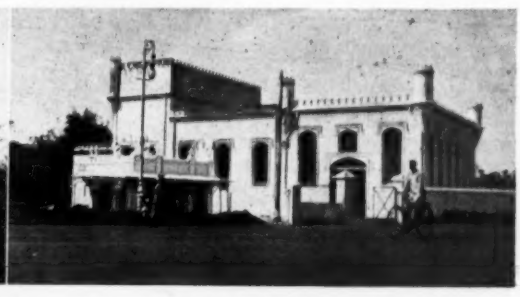
the city. Cossipore grew with the demand to 57,500 kW and still this great Indian city wanted more, and in 1925 a start was made with the New Southern station designed for an ultimate capacity of 150,000 kW of which 35,000 kW has been installed. The stations are linked by two 6,000-V trunk feeders run on separate routes. The electrification of jute mills and other large industries accounts for much of the load, and on a morning's run round with one of the consumers' department engineers I visited jute mills, a steel foundry with 1,500-kVA of arc furnaces, match works, rice mills, ice works, oil, and flour mills, also a large and well-equipped pottery turning out every class of insulator.

Leaving Calcutta on Christmas eve for the delightful (except during the monsoon) three days' sail across the Bay of Bengal, brought me to Rangoon, one of the most famous ports in the east, set amidst beautiful tropical surroundings on the banks of the Rangoon River. The electrical and transport needs of its 400,000 inhabitants are looked after by the Rangoon Electric Tramway and Supply Co., Ltd., a view of whose up-to-date 17,000-kW station, recently appeared in the Electrical Review. The same enterprise and load cultivation is to be found as with the other Indian undertakings, and to a mere westerner it is astounding how they keep up their enthusiasm in such a climate. The distribution pressure was recently changed from 115/200 to 230/400 V, and for this purposes a special shop was organised for rewinding some 15,000 consumers' fans, no small undertaking for a supply company. A fine showroom in Merchant Street displays all the latest current-consuming apparatus and a big staff of wiremen are constantly employed on new installations and combating the ravages of, among other things, the white ant, which seems to delight in setting examinations for them in fault finding. The Adamjee match factory and the Burma Railway shops at Insein are two of the largest power consumers, and motors of various sizes drive the machinery for many smaller industries in the town and district. The company builds its own lamp standards of reinforced concrete, also distribution pillars and meter boxes, as these require no painting, a great point in their favour in the Rangoon climate.

The Rangoon Showrooms

Returning from Rangoon to Calcutta early in the new year I left for Northern India to see some of the smaller electrified towns under the control of Octavius Steel and Co., Ltd., of Calcutta. Patna, a town some 130,000 Indians and about 200 Europeans, on the south bank of the Ganges is the capital of the Province of Behar and Orissa and has a flourishing electricity supply undertaking, which in addition to the usual lighting and fans, does all the street lighting. Nearly half the output is for a large number of small motors, and bulk supplies are given to the East Indian Railway at Khagole, and the Military at Dinapore. The existing Diesel station is soon to be replaced by a steam turbine plant. Practically the whole of the distribution over a scattered area is by overhead mains; not the happy-go-lucky sort of construction seen in Canada and U.S.A., but equal to the best class of work at home, and a credit to the engineers and Indian linesmen alike.

Tropical Transmission.



Rotary Sub-station, Madras

My next call was at Mirzapur, further west on the same side of the Ganges, a busy little town of some 60,000 inhabitants, which is being electrified at the present time, and is known all over the world for its carpets of beautiful design and wonderfully fine texture. The whole process from the raw wool to the finished product may be seen carried on to-day just as it has been for hundreds of years, but the electric motor is now taking on the job of spinning the yarn for the carpets in a mill erected near the generating station.

From here, calling at Allahabad, which was preparing for one of the great annual influx of pilgrims, I travelled to Shahjahanpur, now one of the centres of the sugar industry in Northern India. The sugar treatment plant was previously driven by four coolies, but since the advent of the electricity supply a 3-h.p. motor does the job more quickly and gives a better quality sugar. There are many sugar works and so the load on one of the neatest small Diesel stations I have seen grows apace and everyone is pleased with doing things the electric way. When discussing with the Hindu owner of a brass works the question of putting down a small motor-driven rolling mill, he inquired if he could not melt his brass electrically. If his works were not of the most modern type, his ideas were right up to date.

From Shahjahanpur in the north I travelled to Ahmedabad in the west on the Sarbarmati River. With a population of some 500,000 Indians and 300 Europeans the present Diesel station of 2,300 kW capacity has only scratched the surface of the possible demand, and a scheme is on foot for a big steam station that can tackle the cotton mill load, amounting to some 40,000 kW. For all small industries the oil engine is being ousted by the electric motor, and the persuasive powers of the enthusiastic staff.

From Ahmedabad I came south to Surat on the Tapti River, famous as the first place occupied by the British in India. With a population of 85,000 Indians and handful of Europeans, the 500-kW load consists of motors driving a large number of small industries together with the usual lighting and fans making up the high yearly average of 580 kWh per consumer. This also is a Diesel engine station and about one-third of the mains are underground. Crossing India once more from Bombay, a journey of 794 miles occupying two nights and a day, brought me to Madras, the climate of which is very hot. The area of supply is about five miles wide and ten long, some 140 miles of streets are served, and the annual sale is over 20 million kWh. Here again, every class of load from bulk supply to the small lighting consumer is attracted by suitable rates and kept satisfied with the excellent service-after-sale arrangements. A maximum load of nearly 6,000 kW is the result, and the very high average of 2,840 kWh per consumer per annum. Leaving India a week later I travelled south to Colombo in Ceylon where all the electricity supply is controlled by the Government Department of Electric Undertakings. In Colombo itself there is a big Diesel engine station that has been running for a good many years, and also a modern steam turbine plant in a different part of the town. Electricity supply is also available up country at Kandy and Nuwara Eliya (Newralia). Apart from electrical interest Ceylon, some 400 miles north of the equator is unsurpassed for the beauty and range of its landscape and scenery. At Nuwara Eliya, 7,000 ft. up, the climate is like a beautiful autumn at home, and a welcome change from the sticky heat of Colombo on the sea level.

After seeing the progress that the supply of electricity is making in all the Indian towns that I visited, for lighting and power, one is led to the conclusion that if the right apparatus can be supplied at a reasonable price and suitable rates are charged for the current, the people can be educated to adopt it for many other purposes. Fans, a necessity for Europeans, are being installed by Indians, as also are refrigerators. Small heaters for use in wardrobes and other places, during the wet season are beginning to catch on and a fair amount of business is done in water heaters.

Cooking for the middle and lower-class Indian is a difficult problem, but as he has already taken up the pressure oil stove, often a source of great danger in such inexperienced hands, it should not be difficult to tempt him with a simple form of electric heater, which would be specially designed to take the curved bottom of the cooking vessels. The market for power plant is extending as licences are being rapidly acquired for the electrification of many of the smaller towns. I have seen some quite good small electric heaters made entirely in India except for the nichrome wire which had to be imported; water heaters, irons, and simple lighting fittings are also produced.

I am not aware of anything in the way of electrical plant being made in the country. The Americans are pushing hard, and are getting, as far as I could see, all the refrigerator business, which is assuming big proportions. The Swiss and Germans are also very active, and supply "Association" or "non-Association" grades of cable, according to the labels.

The total demand for all accessories must be enormous, and firms wishing to get a share of the business should see that they are efficiently represented or have their own man, of the right stamp, on the spot. The political troubles are bound to have a reactionary effect on trade, but this, I think is only a passing phase, as the Indian has got the electrical idea, and the politicians will not stop him. There is practically no gas competition, so that the only alternative is the oil lamp, and the oil engine which he generally forgets to lubricate. The supply engineers have a difficult job compared with conditions at home but one and all are a cheery lot, and their unbounded hospitality and kindness to me, made a somewhat arduous tour very much more pleasant than it would otherwise have been. I also met many Indians in various stations of life and from one and all I received the utmost courtesy and assistance.

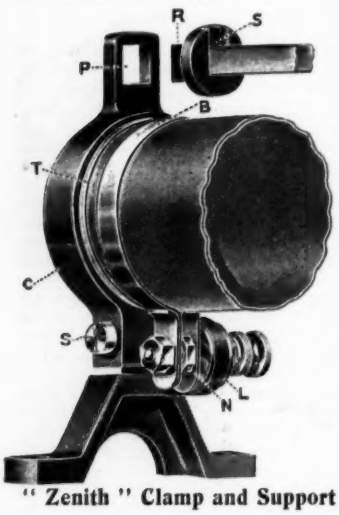
In conclusion, it may be said that those going out to India to stop must be prepared to work hard and play hard.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Tubular-resistance Clamp

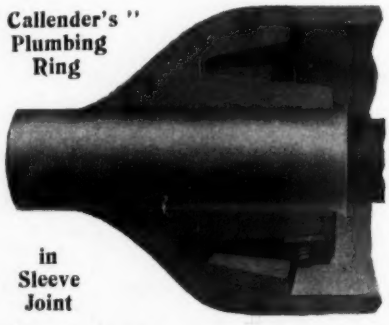
In order to overcome the disadvantages of previous designs of clamps and supports for tubular resistances the ZENITH ELECTRIC CO., LTD., Zenith Works, Villiers Road, Willesden Green, N.W.2, has introduced a new type which comprises in one rigid casting of aluminium-silicon alloy the following features: a clamping part C with ample adjustment to accommodate any unavoidable variation in tube diameter, and which can be securely tightened by a substantial screw; a recess (not shown) which precludes the clamp and support from sliding along the tube, formed to provide a space in which a heat-resisting Micanite bushing is caused to grip the tube when the clamp is tightened; a projecting lug L to which the band B is attached in such a way that whilst it is efficiently insulated, it can nevertheless be adjusted for all variations in tube diameter, and is prevented from turning or moving, even though it is left or becomes loose after prolonged use. This construction effectually prevents any movement of the clamp, band, or tube relative to each other.



"Zenith" Clamp and Support

Lead-sleeve Plumbing Rings

CALLENDER'S CABLE & CONSTRUCTION CO., LTD., 2, Surrey Street, Strand, W.C.2, have introduced a range of plumbing rings for use with l.c. cables with sheath-diameters of from 3/16 to 3¼ in. and lead sleeves of from 2¼ to 6 in. in diameters. The following claims are put forward by the makers of these rings. The rings can be secured firmly in a fixed position, so that the plumbing of the lead sleeve centrally over the joint is ensured. There is no risk of the joint being eccentric with the lead sleeve. Less time is required to beat down the sleeve into position for plumbing. There is no likelihood of the cable being damaged during the beating-down process, as the force of the blow is expended over a big area, and there is no risk of hitting the cable with the beating mallet.



"Callender's" Plumbing Ring in Sleeve Joint

A Car-battery Charging Set

Under the name of "Davenset Auto-Charger," PARTRIDGE, WILSON & Co., Davenset Works, Leicester, have recently introduced an apparatus to enable electric batteries of motor vehicles to be charged *in situ*. It is a neat outfit measuring only 20 in. by 7 in. by 7 in., and is housed in a robust steel case, amply ventilated and finished in black crystalline enamel, with chromium-plated relief. A carrying handle is provided, and there is provision for wall and floor mounting. The charger can be connected to any a.c. supply up to 250 volts from 40 and 100 cycles. The output leads terminate in two substantial polarity-indicating clips for attachment to the battery terminals. Voltage control is automatic, and whether the battery be 2, 4, 6, 8, 10 or 12 volts, the charge rate remains constant at 5 to 6 A, as indicated by an ammeter on the upper side of the case. The apparatus is supplied complete with a Philips rectifying valve, two resistance lamps, and an ample supply of flexible lead.

New Fractional H.P. Motors

The CENTURY ELECTRIC COMPANY, St. Louis, Missouri, announces a new line of fractional horse-power motors, with interchangeable mounting dimensions, in repulsion-start induction and split-phase single-phase, squirrel-cage induction three-phase, and d.c. types. The bearing brackets of this design are said to offer unusual protection against falling objects, dirt, or dripping water. These motors have rolled-steel frames, welded steel feet, slotted for belt adjustment, and bearings machined from phosphor bronze castings. They are equipped with the "Century" wool yarn system of lubrication.

Lead-sleeve Joint Boxes

A recent introduction of CALLENDER'S CABLE & CONSTRUCTION CO., LTD., 2, Surrey Street, Strand, W.C.2, is a range of lead-sleeve service and tee boxes designed for use with compound-sealed plumbed lead sleeves. Twelve ranges of multi-core service and tee joints cover all ordinary requirements. The sleeves are chill-cast, non-porous and much stiffer than pressed lead sleeves, thus giving the chill-cast sleeves the great advantage of being easily handled without deformation. The outer cast-iron protecting boxes are of the lid type, neat in appearance, light but strong, and are provided with armour clamps.

A "Callender's" Lead-sleeve Tee Box

All-insulated Transformer Outfits

A new type of all-insulated portable transformer has been designed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, with a view to overcoming the danger of shock when using handlamps on a.c. circuits in damp or exposed situations. The unit as supplied consists of a step-down transformer with two handlamps and the necessary sockets and plugs; it has received the approval of the Home Office and is made throughout in England. The transformer is double wound for a primary pressure of 230 V, 50 cycles, single-phase, the secondary pressure being 25 volts. The transformer proper is contained in a metal box filled with bitumen compound and mounted in a heavy all-insulated case of oiled teak, provided with a solid lid held by four screws and a leather carrying handle; ventilating holes are arranged near the top. For connection to the supply point a length of c.t.s. twin flexible cable, suitably bushed in the case, is provided. The internal connections are made with stout insulated wire, and two special 2-pin "outlet" sockets are fixed at opposite sides of the case. These plugs are not interchangeable with those generally in use in this country.

"G.E.C." All-insulated Transformer showing One Lamp

An X-Ray Tube Input Meter

In order to overcome the difficulties associated with the accurate measurement of the energy input of X-ray equipment, PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2, have introduced a specially designed instrument which works on the ballistic principle. This mA-seconds meter is a moving-coil instrument in which the period of oscillation is greatly prolonged by increasing the length of the needle. With current impulses which are short in relation to the period of oscillation of the coil, both current intensity and duration are, it is claimed, correctly indicated as the product of the two. Further, as the movement of the needle over the scale is relatively slow, greater accuracy is obtained when making observations. The instrument has a measuring range up to 250 mA-seconds, which is more than sufficient for ordinary requirements. With readings of 75 mA-seconds and over, the period of oscillation is 7 seconds; with lesser scale readings the period of oscillation is reduced to 4 seconds. For exposure times up to 0.5 seconds, the readings are claimed to be *absolutely accurate*. With an exposure of one second, the degree of error is less than 5 per cent. The instrument is not intended for measuring milliamperages with longer exposures.

"Philips" Ballistic mA-seconds Meter

The Societies and their Doings

The subjects treated of this week are alternating-current bridge measurement errors, phenol-formaldehyde moulding, modern domestic illumination, long-wave radio phenomena, token systems of railway signalling, and the power consumption of boiler-house auxiliary plant.

A.C. Bridge Measurements

THE fact that it attracted to the I.E.E. informal meeting many members who do not often attend these debates in itself justified the choice of the subject of "Some Difficulties of A.C. Bridge Measurements."

Mr. L. S. Crutch occupied the chair and Dr. A. Rosen opened the discussion, his primary object not being to enumerate the merits or demerits of particular forms of bridge networks, but rather to direct attention to some of the sources of error which are encountered. One of the things which formerly limited the range of such measurements was the unsteadiness in frequency of the source. When using a machine to supply the current, work with a bridge in which the balance varies with the frequency is a tedious and tricky job, and a number of systems have been devised to regulate the speed automatically. The introduction of the valve oscillator has improved old methods and made new ones possible, particularly those methods in which frequency enters into the balance. The valve generator is capable of still further improvement and English manufacturers should produce an oscillator of which the frequency is independent of load and of the voltages of the filament and plate batteries, with a pure wave form, and of which the output is continuously variable over the whole of its range. Valve amplifiers in the detector circuit can increase the sensitivity a hundredfold, but in doing so they may magnify the errors, so that special care has to be taken. In some cases increased sensitivity permits measurements to be made with smaller quantities, *e.g.*, in finding the power factor of dielectrics, and it is an advantage to be able to obtain a reliable figure on a small sample of the material. One of the most fruitful causes of trouble is the induction of spurious currents, while the effects of the earth capacitances can be eliminated without losing the simplicity of balance of the original bridge network and without restricting the potential of the unknown arm with regard to earth by the use of multiple screens in which one is completely enclosed within another. Special care is needed with adjustable resistances, as the combination may have an appreciable phase angle, although the individual coils are non-reactive. Another difficulty is that the phase angle varies with the number of coils in circuit, which can be overcome by providing each decade with its own shield and correctly arranging the shields, but in doing so the phase angle is increased. It is a choice between a small variable phase angle and a larger fixed one, and for precise work the latter alternative is preferable. In general it is an advantage to use a bridge in which there are two adjacent equal arms, *e.g.*, fixed resistances. In this case it is not necessary for these resistances to be non-reactive, providing they have the same time constant. Further, inequalities can be detected and allowed for by interchanging the ratio arms and taking the mean of the two sets of readings. Many causes of error can be eliminated by the substitution method, using a dummy balance; the bridge is first balanced with the unknown in position and the unknown is then replaced by a suitable variable impedance, which, providing that the conditions have not been altered by the substitution, gives very accurate results and, furthermore, is independent of any errors in the other arms of the bridge.

Phenol-formaldehyde Moulding and Composition "Fillers"

IN the course of a paper recently submitted to the Junior Institution of Engineers, Mr. Leonard Clegg treats of a subject of increasing importance, namely, the nature of synthetic resins generally, and describes at length those made with phenol-formaldehyde as a base, the method of manufacturing the raw material, the various tests applied to it, and its conversion by heat and pressure into all kinds of articles.

The properties of various "fillers" are described, wood flour or cellulose fibre being the most used in moulding compositions of the infusible type, as, although bulky, the resin not only covers but impregnates the fibre, thereby giving strength and homogenity to the product; other "fillers" are asbestos, yielding a product low in tensile strength, but resistent to shock and high temperatures; cotton flock and linters are used in small proportions to enhance shock-resisting properties; silk flock has been used when mineral "fillers" are employed in articles requiring to be machined owing to the superior polish obtainable. Paper, canvas, and fabric are used extensively in the manufacture of laminated press board for noiseless gears and pinions. Both dyes and pigments are used in the colouring of moulding compositions, dyes being preferable in compositions to be used for electrical insulation, while pigments are preferable for products to be used for purposes requiring heat insulation. Another filler is a waste product of paper mills, being composed of very small fibres of esparto grass which fall through the screens on to which the prepared pulp is fed in the manufacture of paper, the fibres being largely oxycellulose into which part of the esparto grass has been transformed during prior treatment, together with the bleaching agent taken up by the fibres. After a concentration process it is dried, and its water content reduced to 3 per cent. or 4 per cent. to make its constituents about 50 per cent. cellulose and 50 per cent. mineral matter. It is then ground, passed over a magnetic separator, and then goes to the mixer, which is heated prior to receiving the material; phenol is added and later formaldehyde, the plastic mass passing between rolls which convert it into sheets, which become hard on cooling. The sheets are then broken up and passed through a disintegrator which grinds them to powder, afterwards dried, sifted, different batches blended, and the powder passed down another magnetic separator. The subsequent processes to convert the powder into moulded articles requires hydraulic presses capable of exerting one ton per sq. in., means for heating the platens, metal moulds, and polishing apparatus. It is of the highest importance that close collaboration should exist between the composition manufacturer and moulder and purchaser of mouldings, so that suitable compositions may be selected to suit the purposes for which the moulded articles are to be used.

Modern Domestic Lighting

DURING the past five years a complete change has come over the civilised world's outlook on domestic lighting, for which we owe much to France and Germany, thinks Mr. H. T. Young, A.M.I.E.E., in whose opinion the Paris exhibition of 1923 without doubt established the foundations of the new epoch. In his Illuminating Engineering Society paper he explained how the architect and decorative artist have discovered the "Art of Lighting," the people of the world have appreciated it, and how now it is rapidly becoming the dominating feature in internal decoration.

To bring about close and effective collaboration between the artist and engineer a necessary first step is that the engineer should remove to the inner recesses of his mind and to the tail-end of his vocabulary that word "efficiency." This process may not be easy; he has been trying to save watts for so long and as he must, by his training, save something, he can to advantage turn his mind to watching his volts. To-day, and for the future, "effectiveness" must come first. Secondly, standardisation must give way when art is concerned with modern lighting; possibly at no other time in the history of the world has creative applied art been itself in such a state of flux. The speed at which we live and work to-day demands change and variety in our homes and it is necessary to keep in mind the great change that is also taking place in domestic architecture, furnishing, and decoration.

Of course it will not be possible for the masses of the people to whom electricity is now available to have each fitting specially designed, but even in very small homes there should be no necessity to limit lamps to one per room, or to adopt one type of fitting for lighting a house throughout. The electrical showrooms of the country are selecting fittings with greater discrimination than ever before and a sincere attempt is being made to allow the shape of the light source to govern the shape or form of the fitting; interesting lines of light can also be obtained with this system.

Architectural lighting, forming an integral part of the room construction, calls for special structural work and is not so easy to change, which considerations stand somewhat in the way of its development domestically. An important point for both the designer and engineer to bear in mind when fitting large illuminated surfaces in a room is that the light source must be bright to be interesting. Mistakes are already being made in the attempt to spread out a small amount of light over too large an area. Indirect lighting from ceilings without assistance from low interesting visible light sources somewhere about sight level is tiring and depressing. The best lighting of to-day, and possibly of the future, seems to be afforded by the combination of indirect with direct light sources.

The manufacture of the modern fitting calls for considerable thought. In that part of the year when artificial light is most required we, in this country, suffer from changes of weather conditions that do not exist in many other countries. It does not, therefore, follow that all materials used in other countries will suit this one. For instance, heavy cast, or moulded, figured, and sandblasted glass was used extensively and successfully on the continent, but over here, particularly in and around our big cities after humid days and foggy days, it quickly becomes yellow and dirty, and the cleaning of it is a most difficult operation. Glasses of moderate thickness, with smooth surfaces, or one side only sandblasted, are now made

with interesting mixtures of opalescent shades and seem to be most suited to our climate. Intensities are becoming more a matter of taste; while hard and fast rules cannot be stated, the accompanying table serves as a guide to the minimum.

I.—MINIMUM INTENSITIES.

Dining room: table 4 to 5, sideboard 5 ft.-c.
Sitting room: general 3 to 4, reading chairs 4 to 5 ft.-c.
Bedroom: dressing table 5, bedside 3 to 5 ft.-c.
Bathroom: general 4 to 5, mirror 5 to 7 ft.-c.
Kitchen: table 5, cooker 4 to 5 ft.-c.
Scullery and pantry: 4 to 5 ft.-c.
Corridors and staircases: 2 to 3 ft.-c.

It is impossible to lay down rules for the number of lamps required in any particular room, but many more will be required in the future than in the past. To allow 15 ceiling points of 60 watts each and four other lamps in addition for a dining room is not extravagant. The total load is 1,000 watts, costing less than 1d. per hour to run. The same loading for a sitting room is quite reasonable, and compares very favourably with the cost of an hour's enjoyment on the part of one person only of cigarettes, and is less selfish.

When installing the wiring it is desirable to provide for 50 per cent. margin over the known, or estimated, load and to allow for as many plug points as possible. Whenever possible the lighting of rooms should be arranged on two fuses so that little inconvenience is suffered if one fuse blows. Better understanding of the human reaction to light is most essential. Most people to-day live in homes that are inadequately provided with daylight, with windows usually too small and often badly placed, a heritage from the past. Some theorists advance the idea that the ideal way of lighting by artificial means would be to copy daylight and use windows. This would be satisfactory and pleasing for rooms that receive no daylight at all during, possibly, twelve hours of the day, but the appearance of perpetual daylight brings with it monotony at night. Then a change in intensity, direction, and diversity, with flexibility of control, makes the life of the average individual more congenial.

Long-wave Radio Phenomena and Daventry's Field Strength

PREVIOUS experience of long-wave transmission has shown that during the day time the influence of downcoming waves from the upper atmosphere is only appreciable at distances of 300 km. and upwards. In observations made by MR. R. NAISMITH, A.M.I.E.E., at Slough of the Government transmitter (GBR) at Rugby (λ=18,700 m.), which is only 111 km. distant, surprisingly large variations of intensity were found during a 6 months' observation period. Experiments showed that the effect was undoubtedly propagational in origin, and demonstrated that, on occasion, the magnitude of the downcoming wave might be 40 per cent. of the direct ground wave. These striking results were further emphasised by the fact that signals were very different at two places nearly equidistant from the transmitter, although simple theory would lead one to expect close agreement. Contrary to the usual assumption, reflection from the ionised layer plays a part in the propagation of long waves, even at relatively short distances. The intensity of the reflected wave depends very markedly upon the direction of propagation, even for an aerial which appears to have no favoured direction of ground-wave transmission. For transmission from south to north the reflected wave is stronger than for transmission from east to west, which strongly suggests that the earth's magnetic field plays a part in the effect. The results appear to indicate correlation between short-distance (under 400 km.) and long-distance (over 1,000 km.) observations, which does not exist when correlation is attempted with observations over medium distances.

The author has also made a series of measurements in different parts of southern England of the field strength of the British Broadcasting Corporation's long-wave Daventry (5 XX) station. An intensive survey of Cornwall indicated rapid attenuation of field strength on crossing Bodmin Moor. Beyond that area symmetrical contours were observed. Their existence is attributed to the large irregularly shaped moor, rising to the hill of Brown Willy. This conclusion was further tested in Devon, where confirmation was obtained. Experiments were made on the effects of coastal refraction, and on energy from the upper atmosphere. Negative results were obtained which proved that the effects, if any, were small.

Both papers, which were read before the WIRELESS SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS in London, describe work carried out by the Radio Research Board of H.M. Department of Scientific and Industrial Research.

Electrical Token Systems of Railway Signalling

THE broad idea of the token system of railway signalling, which requires the driver of a train to be in possession of a licence in the form of a token before he can travel over a specified length of track, was outlined in a JUNIOR INSTITUTION OF ENGINEERS paper by MR. W. S. ROBERTS, who pointed out that while such systems were in use generally on single lines they were also economically applicable to the block working of double tracks. For economical reasons railway authorities were to-day seriously considering the conversion of some double tracks to single lines; indeed such changeovers had already taken place and in the author's opinion the explanation was to be sought in the progress which had been made in the development of token systems to which COL. SIR JOHN PRINGLE (then chief inspecting officer of the Ministry of Transport) referred in a paper read before that Institute in 1922, when he is stated to have said "It may be justly inferred, therefore, that single lines are operated under token systems with a higher degree of security than railways with two or more tracks."

To meet the difficulties of the early systems the following were evolved in the order stated: (*a*) electrical tablet (*b*) electrical staff (*c*) Neales electrical (*d*) electrical key, and (*e*) the improved electrical key systems. Full detailed descriptions of the last two systems showed that they had been developed so as to safeguard most contingencies in single-line working without impeding traffic, as well as safe-guarding the lives of workmen engaged on maintenance work between stations, providing for the conversion of several short block sections into one long section during times of light traffic, and in exchanging tokens automatically while the train is travelling at speed by apparatus stationed on the track and making contact with other apparatus on the engine, satisfactory exchanges being effected at train speeds as high as 60 miles per hour.

Power Consumption of Boiler House Auxiliary Plant

IN his INSTITUTE OF FUEL paper on this subject, MR. P. H. N. ULANDER has confined his attention to auxiliaries in a somewhat restricted sense, the boiler-feed pumps and the draught fans only being considered; the power consumption of the coal-handling plant is not included. It is pointed out that the size of a boiler unit has grown to such an extent that the annual fuel consumption of the auxiliaries for a single boiler may amount to many thousands of tons of coal, and the economic aspect of their power consumption calls for serious consideration. All the auxiliaries dealt with are of the centrifugal type, and their performance is illustrated graphically in the paper, characteristic curves being reproduced showing (1) the static pressure-volume characteristic; (2) the b.h.p.-volume characteristic; (3) the efficiency-volume characteristic; also a fourth curve shows the system resistance. Various types of fans are discussed, it being shown that the fan with a backward-curve blade has the highest efficiency, while the radial-tip fan has a somewhat lower efficiency and the multivane fan is inherently the least efficient of the three. For a complete analysis of the economics of the boiler house, capital expenditure, the demand charge, and the energy charge are discussed at some length under separate headings. It is pointed out that in some cases the pumps are driven by steam turbines, and that the tendency of some modern large American power stations to extend such use of steam turbines calls for attention. The argument against the small steam turbine has been its low efficiency, but, as the capacities of the driving units required nowadays for both feed-pump and fan drives are appreciable, it is possible to construct turbines of high efficiency at prices competitive with electric motors. This type of drive has important advantages due to reduced demand charges, and for sets of more than 560 h.p. capacity a thermodynamic efficiency of over 70 per cent. can be reached; with re-action turbines a flat efficiency characteristic is obtained, while the flexibility of this type of drive is equal to, or better than, that of the d.c. motor. Performance curves of auxiliary turbines built in the United States are reproduced in the paper, it being stated by the author that, so far as he knows, such turbines are not available on the British market.

Finally the author emphasises the point that the buyer in Great Britain frequently gives to the boiler maker the power to weed out schemes which are not considered sufficiently attractive, but the boiler maker must be unaware of the method of analysis the buyer has in mind, unless it is stated in the specification. He therefore hesitates to put forward proposals which increase the total price of the tender, in spite of the fact that such proposals might easily prove very attractive if the economics of the whole plant were taken into consideration. On the other hand, in the United States, where the history of the large boiler unit is older than in this country, the attention paid to auxiliary efficiency and drive is considerable, and specifications in that country usually contain definite rules for comparing bids for auxiliaries. A typical specification is in the paper in the form of an appendix. The tendency of development is in the direction of larger power stations, larger boiler units, higher boiler pressures, and increasing attention has therefore to be given to problems connected with auxiliary plant. Consequently higher quality equipment will be justified, as the reliability and efficiency of auxiliary plant will become of increasing importance.

Supervisory Control Equipment

Descriptive Details of Apparatus Made in England for Remote Sub-station Control in New Zealand

SUPERVISORY equipment for the remote control of three sub-stations, two of the rotary type for traction purposes and one of the transformer type, of the Auckland Electric Power Board in New Zealand, has recently been completed by the Automatic Telephone Manufacturing Co., Ltd., in collaboration with the Metropolitan-Vickers Electrical Co., Ltd.

The scheme embraces a control board situated at King's Wharf and sub-stations at Remuera, Point Chevalier, and The Drive, provision having been made for its future extension by the addition of three more traction and three other sub-stations, which may ultimately be included in the network. Several of the latter already exist; they are manually operated, but their position indications are set on the present mimic diagram on the control desk, by the supervisor on receipt of switching information by 'phone from the particular sub-station.

Four wires, each of 16 S.W.G. gauge, are available in a cable (which also includes the necessary cores for the feeder protective gear and M.V. "Translay" relays) that follows the high-voltage feeder route from the control board at King's Wharf to the present most distant sub-station at Point Chevalier, a total distance of 16 miles. Over those four conductors the entire supervision, control, and indication of all the sub-stations will be effected by the aid of Strowger automatic switching equipment.

Owing to the exceptional humidity of the climate at Auckland the equipment has been given a special tropical finish, whilst lamps are to be fitted in the apparatus cabinets at the sub-stations to maintain them at a constant temperature higher than that of the surrounding air. The prevalence of dust in that area also prompted special precautions, and glazed dust-proof steel covers have been fitted to the cabinets, permitting inspection of the apparatus without necessitating their removal save for purposes of adjustment; an additional precaution against the dust evil is the fitting of duplicate contact springs.

The control board is of the desk type, the various keys, operating buttons, signal lamps, &c., being disposed in their relative positions in a mimic diagram of the complete network on the sloping panel as shown above. The associated relays and switches are mounted on separate racks and are connected to the board by cabling. To facilitate adjustment the apparatus is mounted on a "gate" which forms part of the supporting rack. This gate can be swung outwards so as to give access to the rear and wiring.

Of the four pilot wires, the A and B wires are utilised for selecting the required sub-stations, selecting the particular circuit breaker, or other unit, to be supervised, operating the selected circuit breaker, reading remote meters with the aid of "Midworth" repeaters; and for calling and conversing by telephone with any official who happens to be visiting any of the unattended sub-stations. The same pair of conductors is utilised to signal back from a sub-station to the control room the condition of any circuit breaker and for calling and conversation with the control room supervisor. The remaining two C and D wires are utilised for preparing all sub-stations to receive the selecting impulses, and at the same time to guard the A and B wires against intrusion by an unselected sub-station. At the sub-stations the C and D wires serve as the necessary channels for releasing the control-room equipment, so that a sub-station can return checking signals on the completion of any operation, which is necessary because the supervisor might be simultaneously selecting and supervising another unit. They also serve to prevent another sub-station checking back to the control room whilst the first is still in the act of so doing. In the event of such involuntary overlapping the subsequent signals are "stored" and follow in their normal sequence, so that no supervisory signals are lost or mutilated.

The plant at Remuera comprises two 500-kW automatic rotary-convertors, and that at Point Chevalier two 1,000-kW automatic rotary-convertors and a negative booster, the latter being a three-machine unit, so that either or both of two long negative feeders can be boosted as required. The equipment at The Drive includes 22- and 6.6-kV switchgear and transformers. The 22-kV switchgear is all of the M.-V. metal-clad, duplicate-busbar, K.3 type with a.c. motor-operated closing mechanisms.

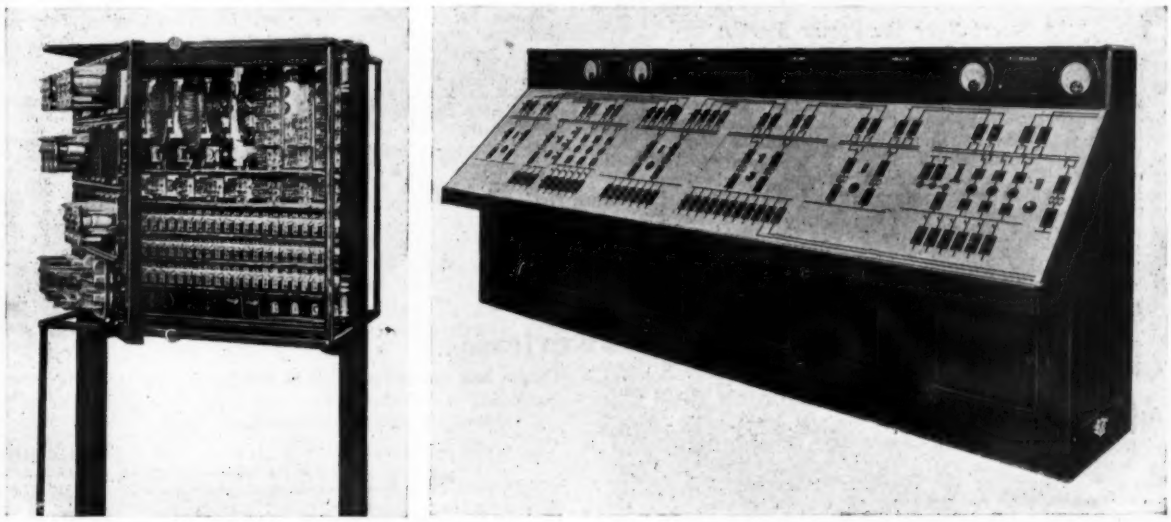
Normally the conditions of apparatus are indicated by the glowing of coloured lamps in the mimic diagram on the control board, the extinction or change of illumination from an "in" to an "out" lamp, for example, indicating a corresponding change in the associated circuit breaker at the distant sub-station. The procedure in connection with meter readings is somewhat similar; the supervisor selects the desired meter and associates it with "Midworth" transmitting gear at the sub-station. Following the transmitted impulses the control-board meter then reproduces the indications of the selected meter at the sub-station.

The receiving circuit at the control board embodies an important feature whereby in the event of any departure from synchronism of the stepping switches at that point when pulsed from the sub-station, such as might arise from line interference, surges, &c., the sub-station is caused to repeat its signals continuously until the switches again synchronise. Thus the resultant lamp indications on the control board mimic diagram represent actual conditions at the sub-station and reliability is assured.

In addition to a checking key there are common signals designed to afford extra warning should the control board supervisor fail to notice a single lamp change. By the simple manipulation of keys and push-buttons on the mimic diagram in front of him the supervisor is enabled to visualise exactly what is happening at the outlying stations and, if necessary, consult by telephone with the sub-station attendants concerning any emergency.

The functions which the equipment is called upon to perform at Point Chevalier are, in addition to starting and stopping the convertors and boosters, the control and/or position indication of numerous circuit breakers and contactors, the carrying out of the Board of Trade leakage tests on the track feeders, and the indication of the sub-station's output. At The Drive sub-station it controls and indicates the positions of 14 circuit breakers.

Messrs. Preece, Cardew & Rider were the consulting engineers for the entire scheme, and by the incorporation of standard Strowger automatic telephone-exchange components the apparatus follows the general lines of similar supervisory control equipment supplied through the M.-V. F. Co. by the A.T.M. Co. to the Bombay, Baroda and Central Indian Railway, the Central Argentine Railway, and that in process of installation on the Scottish section of the grid scheme of the Central Electricity Board of Great Britain, while other pending installations are on order for the London County Council tramways and the Manchester Corporation.



Relay Rack and Supervisory Control Board for the Auckland Electric Power Board's Sub-stations

A Lignite-fired Power Station

It has been found necessary at the Golpa-Zchornewitz power station to provide housing for miners as well as for the generation staff

By THEODORE RICH

THE Golpa-Zchornewitz power station of 440,000-kW capacity is located in the central plains of Germany to the north of Leipzig; the two latest units are each of a capacity of 100,000 kVA on one shaft.

The station is operated with lignite, 13,000 tons of which are excavated per day from an open pit with the aid of electrically-driven land-dredgers, after an overburden of nearly double that quantity of sand and clay has been removed. Electric locomotives are used for haulage, about 1,600 workmen are employed in excavation work, besides the station staff.

A Street Near the Power Station

As the power station is some way from the nearest town, in order to relieve the labour problem somewhat, the Elektrowerke Company Administration has built a model village alongside the works, the chimneys of which are to be seen in the background of the illustration. The brown Silesian tiles which are laid in overlapping pairs and the painted shutters give a pleasing appearance to the houses. The cooling tower installation, one of the largest in the world, is just out of sight.

Germany is very well provided with cheap fuel from lignite beds which extend from the west slope of the Rhine valley to 60 miles east of Berlin and south into Saxony. It so happens, however, that there is but little condensing water available at most of the beds which are worked.

The main German grid system owes its existence very largely to the fact that it does not usually pay to send lignite for long distances in railway trucks, owing to its water content being so much higher than that of pit coal.

As the chief centres of power consumption are far off, either the fuel has to be briquetted, or else the power has to be generated on the spot and transmitted at voltages of 100 kV and upwards. By coupling up the water power of the south with the lignite beds and linking in with industrial centres the maximum benefit can be got from the water power despite seasonal variations, and the demand for pit coal for power purposes can be diminished in favour of a fuel that can be mined for a cost per ton that can be calculated almost in pence.

The war-time shortage of labour encouraged the development of lignite-power and the transmission lines necessary for its utilisation.

There is little doubt that power from lignite is about the cheapest in the world to generate, although water power has the great advantage of being inexhaustible; an interconnected combination of both is therefore advantageous from the national economic point of view.

It is of interest that a great deal of American capital is invested in the major power developments of Germany.

It can be understood that open-cut excavation covering an area involving hundreds of acres, necessitates special arrangements regarding labour, so the model village with various social, medical, and other institutions has been constructed to meet these requirements.

One does not usually associate power stations with housing schemes, but now that their capacities are becoming so large they have to be treated as factories as far as social features are concerned. Another Continental power station which has a model village for its employés is at Commines on the Franco-Belgian border not far from Lille. This station is laid out for 200,000 kW capacity, and is noted for the pioneer work on pulverised coal that took place after the war. The thanks of the writer are due to the Elektrowerke Company for the photograph, which was taken by the Berliner Bild-Bericht.

Book Reviews

Amber to Amperes. By ERNEST GREENWOOD. Pp. ix+332; figs. 15. London and New York: Harper & Brothers, 1931. Price 15s. net.

This is an absorbing narrative giving a portrayal of the evolution of electricity against a social-historic background. It is written in a delightfully conversational style, free from technical obscurities, and is primarily intended for the layman interested in the progress of modern science. In the comparatively short space of 332 pages the subject can only be imperfectly treated, but there is a good deal that is well explained, and the cumulative effect of the volume is to build up a striking picture of the story of electricity from its early discovery to the present time.

The volume commences with short chapters dealing with amber in Greek mythology, the quest for the mythical "philosopher's stone," and an account of that remarkable personality Leonardo da Vinci (1452-1519), who was an artist and scientist as well as an engineer, musician, poet, and philosopher, and who gave the first correct explanation of the partial illumination of the darker part of the moon's disk by reflection from the earth. Then follow accounts of the early experiments of Hauksbee, Stephen Grey (whose investigations finally led to the discovery of the principle of electric conduction and insulation), Charles du Fay, Franklin, and Bishop von Kleist, who discovered the principle of the Leyden jar. Some perspective is presented of the 18th, 19th, and the beginning of the 20th centuries. After tracing the development of the electric telegraph and telephone, the narrative proceeds to trace the history of radio communication. It shows how Faraday at one time conceived the idea of using the ether surrounding the earth as a conductor for an electromagnetic force, how Maxwell found mathematical proof for Faraday's theory regarding electrical waves and even predicted by mathematical analysis that electrical discharges propagated effects through space in the form of electromagnetic waves, and how Hertz proved by actual experiment the correctness of Maxwell's predictions and disclosed the basic laws surrounding electric wave propagation, which culminated in Marconi's practical applications and subsequent spectacular commercial development. The development of the use of electricity in diagnosis, treatment, and surgery is described, and the concluding chapter of the volume deals with the history of hydro-electric power and a discussion of the relative merits of hydro-electric and steam-power generating plants.

Theory and Electrical Drive of the Loom. By R. H. WILMOT, M.Sc., A.M.I.E.E. Pp. viii+144. London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d. net.

A careful study of the work makes one doubtful as to whether the author has not attempted to embody too much in one volume, and as to whether he has been forced to treat some important details in rather a more perfunctory manner than is desirable. Mr. Wilmot is already familiar as the author of a number of contributions on the electrical driving of looms which have appeared at various times in the Journal of the Textile Institute; these papers reappear as a part of the volume under review, and this accounts presumably for the arrangement of the information. While the work gives due attention to such theory and formulæ as are available, its purpose and methods are essentially practical, and a critical caution is maintained throughout.

The author has carried out an extensive theoretical and practical study of loom mechanism from the mathematical and experimental standpoints and has finally developed a clear and well defined general mathematical theory of the loom. The new problems which are continually arising in connection with loom mechanism are ever calling for new methods of investigation and solution, and it is difficult to provide literature which will keep in advance of the developments which are taking place so rapidly, largely due to the necessity for a more economical consumption of energy and also to the economic factor of the increasing foreign competition to which the textile industry has been exposed during recent years. Commencing with an introductory chapter which describes the general action of the plain cotton loom, the volume proceeds in the next five chapters to deal with the general theory of the loom and in the final chapter with indications of modern practice in group, semi-group, and individual electrical driving of looms, concluding with a valuable technical bibliography relating to the subject.

Engineers connected with the textile industry are indebted to Mr. Wilmot for placing his thorough knowledge and experience of the subject at their disposal, and for filling a rather glaring gap in the technical literature of this branch of electrical engineering. The volume is commended to all who desire to study the theoretical aspects of the electrical driving of looms.

Parliamentary Notes

[By our Special Parliamentary Reporter]

Electric Cap-lamps

On March 24th Mr. Freeman asked the Secretary for Mines whether the experiments for using an electric cap-lamp for pit ponies had reached any conclusion; and, if so, whether it was his intention to authorise their use in mines.

Mr. Shinwell said that with his permission, pony lamps were now being tried out at several mines in different coalfields, and he was prepared to extend that permission on a limited scale to other collieries. But before he gave a general approval for the unrestricted use of safety lamps of this character, it was desirable that they should undergo extended trials under a variety of working conditions, in order to determine the safest and most suitable design.

L.N.E. Railway Electrification

On March 25th Mr. Romeril asked the Minister of Transport whether he was yet in a position to make any statement with regard to the proposal of the London and North Eastern Railway Company for the electrification of the old Great Northern suburban system.

Mr. Morrison said that the London and North Eastern Railway Company had now submitted to the Development (Public Utility) Advisory Committee an application for a grant in respect of a revised scheme for the electrification of the Great Northern suburban lines. The application would receive careful and immediate consideration.

Mr. Hannon asked whether in view of the long delay that had taken place in bringing about this scheme of electrification, the Minister would urge the company to bring it into operation without delay.

Mr. Morrison said he was very anxious that this scheme and other schemes of electrification should be brought into operation as quickly as possible.

Foreign Electricity Meters

On March 25th Colonel Howard-Bury asked the Minister of Transport whether he was aware that foreign electricity mefers were being put into council houses by the Electric Supply Corporation in spite of the protests of the Chelmsford Town Council; and whether he would take steps to see that British meters were used.

Mr. Morrison said that this matter, which had not previously been brought to his notice, was not one in which he had any jurisdiction, but he would make inquiries.

Colonel Howard-Bury asked whether, at a time of great unemployment in this country, it was not the duty of the Minister of Transport to see that British meters were installed. Could he not use his influence with the Corporation?

Mr. Morrison said it must be appreciated that the Ministry was not the owner of electricity undertakings. He was quite sure that among the directors were excellent Conservatives, who would have every regard to the policy of their party.

The Grid in Wales

On March 25th Mr. Hopkin asked the Minister of Transport if he would state what was the farthest point in West Wales to which it was proposed to take the Grid; when it was anticipated that this point would be reached; and what steps were being taken at present for the supply of electricity to the rural districts of Carmarthenshire.

Mr. Morrison said, with regard to the first portion of the question, that it was not contemplated that the Grid system would be taken farther west than Llanelly or that the construction of this line would be completed for another two or three years. Supplies could be made available from the existing generating station at Llanelly for the development of surrounding areas. Three applications for Special Orders to authorise the distribution of electricity in the unoccupied portions of Carmarthen, Cardigan, and Pembroke were under consideration by the Electricity Commissioners.

The Severn Barrage

On March 25th Mr. L. Smith asked the Minister of Transport if he could make any further statement as to when the report of the Committee on the Severn River Barrage might be expected; and what State funds had already been spent in connection with this project.

Mr. Morrison said that this inquiry was being conducted by a Committee of the Economic Advisory Council, which had appointed an expert co-ordinating committee for the supervision of the detailed work involved. He understood that the latter body hoped to be in a position to submit a further confidential report later in the year. The expenditure to date on this investigation amounted to £41,535.

The London Transport Bill

In the House of Lords on March 25th a motion that the London Passenger Transport Bill be committed to a joint committee of both Houses of Parliament was agreed to.

The London Electricians' Strike

On March 26th Mr. D. G. Somerville asked the Minister of Labour if she was taking any action to expedite a settlement of the strike of electricians in London.

Miss Bondfield said that her Department had been in touch with the parties throughout the dispute. She understood that a meeting between them was taking place that day.

Legal

B.T.-H. Motor Patent Extended

In the Chancery Division last week, before Mr. Justice Luxmoore, Mr. Whitehead, K.C., on behalf of the British Thomson-Houston Co., Ltd., applied for an extension of patent No. 9557, of 1915, relating to the method of, and apparatus for, casting squirrel cages in the magnetic cores of induction motors, known as rotors.

Counsel said that shortly after the outbreak of war his clients' works were turned into a controlled establishment, and they had been unable to manufacture the rotor for four years. He asked for an extension for that period.

Mr. Stafford Crossman, for the Comptroller-General of Patents, said that the Comptroller's view was that an extension for three years would be justified.

His Lordship thought that in the circumstances he was justified in extending the period for four years.

An Electrical Company's Claim

In the King's Bench Division on March 27th, Mr. Justice Wright had before him an action by the Ward Electrical Co., Wardour Street, W., against Ralph Diamond and D. Fish, of Shaftesbury Avenue, to recover the sum of £164, the balance due for work done and materials supplied and sold between September and November, 1930. The defence was that the work was done not for the defendants but for Indoor Golf, Ltd. The only issue was whether the credit was given to the defendants, together or individually, or to Indoor Golf, Ltd.

His Lordship entered judgment for plaintiffs, with costs.

Opposition to Transport Bill

After detailed consideration of the Government's London Passenger Transport Bill, the Parliamentary Committee of the London County Council recommends that petitions be sealed and presented against the Bill. The Special Committee on Traffic reports that the financial proposals of the Government have not received the assent of the owners of any of the principal undertakings concerned, either municipal or private, though the Council is given to understand that assents have been received from local authorities owning undertakings which are at present operated at a loss, who would, under the Minister's proposals, be relieved of the necessity of making provision for these losses. In these circumstances, says the Committee, the proposals of the Government may be fairly summarised as seeking the authority of Parliament for the expropriation of undertakings, both municipally and privately owned, operating in a large measure under franchises granted by Parliament, on terms not so far agreed to by the owners of such undertakings, and that the formulæ laid down for the guidance of the arbitration tribunal for the valuation of these undertakings are such as, in the case of the Council, will be strongly resisted. The Committee reminds the Council that under these proposals the ratepayers of London would be deprived of any opportunity of being repaid the amount of over £1,000,000 which they have advanced to the undertaking in the past, and that the Council would be deprived of any opportunity of utilising for the benefit of the inhabitants of the County of London the considerable surpluses which it is expected will accrue from the undertaking as a result of the progressive reduction of annual debt charges as the debt is paid off. The effect of the formula contained in the Bill would be that the Transport Board would assume the responsibility for the service of the outstanding debt of the undertaking as distinct from assuming responsibility for the actual amount of debt outstanding, to the grave detriment of the Council.

Speaking at a dinner last week, the Minister of Transport (Mr. Herbert Morrison) said that he had taken considerable pains to ensure that the proposed Transport Board would be free from political influence. It would be a business body conducting a great business for public ends with the desire to make it succeed.

Employés' Claim for Compensation

We reported in our issue of March 13th an arbitration case in which Sir Harold Morris, K.C., heard a claim by ten former employés of the Lowestoft Electricity Department for compensation in respect of loss of employment or diminution of wages. The claimants' services were dispensed with when the Lowestoft generating station was closed down owing to a change-over to a bulk supply from the Yarmouth Corporation. At the first hearing the Lowestoft Corporation, while not denying liability, maintained that Yarmouth should share the cost of compensating the displaced men. Sir Harold Morris accordingly adjourned the case to enable the Yarmouth Corporation to be represented. The case was resumed in London recently and, as the result, Sir Harold Morris awarded seven dismissed men sums ranging from £68 to £300. Three others, whose wages had been reduced were awarded from £16 to £75 each. The arbitrator decided that the two Corporations should bear equal shares of the compensation and should each pay half the costs of the award. All parties were ordered to pay their own costs.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

From Sir George Sutton, Bart.

Because your editorial columns have in such gracious words congratulated me upon my 50 years' work in electrical industry, I know I may ask you to give me a little bit of your space to enable me to thank the number of kindly people who are interested in our industry and have written to me their congratulations on my long service. Not all who have written are personally known to me, but that seems rather to enhance the value of their felicitations.

There can be no greater satisfaction to a business man than to live to see the industry to which his life has been devoted, holding so high a place in his country's economic life as does the electrical industry to-day: and although the causes for that position are many and varied, those who have borne a part, however small, may justly be proud of, and grateful for, the privilege. I thank you, sir, and all who have so kindly remembered my endeavours.

GEO. SUTTON.

Holborn Viaduct, London, *March 30th*, 1931.

The Life of Electric Lamps

My members have read in your issue of March 27th a letter from Mr. C. Turnbull of North Shields, making inquiry as to the quality and performance of Pearl lamps, and in the event of there being doubt in anybody's mind as to whether the inside frosted (Pearl) lamp is as good a lamp as the clear from the point of view of its intrinsic quality and life, I desire to make the following statement:—

The members of the E.L.M.A. state unhesitatingly that, as a result of two years' careful study over a great volume of tests made, the internally frosted (Pearl) lamps manufactured and supplied by members of E.L.M.A. are of equal quality to their clear lamps and, of course, have the greater advantage of giving a more diffused light.

I am authorised to state emphatically that the internal frosting has no deleterious effect on the lamp.

These statements can be supported by a large amount of data, and I am sure my members would welcome a visit from Mr. Turnbull to their factories, where the inside frosted (Pearl) process can be demonstrated in full, and actual tests shown. I should also like to draw your attention to the fact that my members guarantee to supply Pearl lamps fully equal in every way to clear lamps made to B.E.S.A. Specification.

C. W. SULLY,
Director
Electric Lamp Manufacturers' Association.

London, W.C.2, *March 30th.*

In reply to Mr. C. Turnbull's inquiry of March 27th, the life of the "Pearl" lamp is, in my experience, equal to, if not greater than, that of the clear type. I base this statement on a test in which the original installation was carried out using only "Pearl" lamps. The number of these lamps supplied corresponded with the lighting points. As this installation was abroad where difficulty was found in obtaining replacements of the same type, renewals and extensions had to be made with other lamps of British manufacture. With the exception of lamps broken or in positions of extreme vibration only about 50 per cent. of the "Pearl" lamps failed to last until the end of the contract, in which these lamps had been in use for several hours every day for three years—many of these lamps still doing useful service after well over 3,000 lighting hours. The renewals, however, had in practically every case been replaced several times. The filaments of the "Pearl" lamps appeared to be particularly robust and stood up well against extreme voltage fluctuation.

I can only add that on any future large works I should recommend the use of "Pearl" lamps for both offices and houses. I am quite willing to supply anyone with more complete details.

March 28th, 1930. ELECTRICAL.

Engineering Degrees

Graduate I.E.E. raises an interesting point in his contribution to the correspondence on Engineering Degrees. He complains that after passing his examination he is no further ahead.

From personal experience I should say that in municipal undertakings degrees or diplomas are of little use to the man "well down the ladder." One large station in particular still persists in drawing its shift engineers from the switch room. Switchboard attendants are nice fellows, &c., very useful with a feather duster and so on, but not really the right type of man to take charge of a few large turbos or a battery of boilers. This type of man may eventually become a charge engineer, never by merit, but by some peculiar methods which municipal stations seem to acquire.

A junior under such a man has little chance of getting ahead, the senior will, if necessary, take the fullest advantage of the junior's knowledge, but at the same time take great care that the chief of the undertaking remains in ignorance of his junior's abilities.

Whilst the "half-way up" jobs are held by men who have served behind ironmongers' counters and old time boiler stokers, &c., chances for the young degree man's promotion are very remote.

Better by far to get into a commercial concern where merit is the deciding factor.

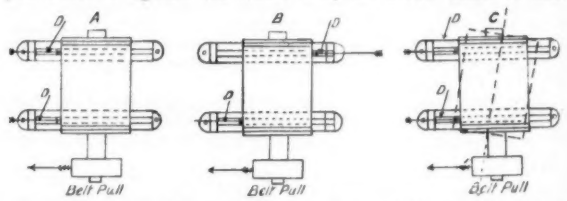
March 30th, 1931. ENGINEER.

Motor Slide Rails

I should be glad to have your readers' views on the correct way to put down slide rails under motors.

Personally I put them down as fig. B, but quite a number of engineers seem to think this a wrong practice.

My contention is that if rails are put down as in fig. A, and you want to tighten the motor belt, the motor tends to take



up a position as shown in fig. C (exaggerated) as the point of the slide rail tightening screw marked X on fig. C becomes a fulcrum, but if rails are put down as fig. B, the back tightening screws prevent this.

It is difficult to convince my friends that my method is right as the majority of motor manufacturers illustrate their catalogues with slide rails put down as in fig. A. I have got 150 motors running and find my method easiest when it comes to belt tightening.

Bexley Heath, *March 25th*, 1931. S. PENFOLD.

Motor Impregnation

With reference to Mr. Dunlap's letter in your issue of March 27th, there is no doubt that the method used by some manufacturers of merely dipping windings into a varnish tank is not sound practice. While a machine treated in this fashion may run satisfactorily under good working conditions, it is bound sooner or later to give trouble when the conditions are unfavourable, such as machines exposed to fumes or extreme humidity, especially when they may be standing idle for long periods.

Mr. Dunlap infers that the only alternative is vacuum impregnation, but I would suggest a third method which experience has shown me to be preferable, even to vacuum impregnation. This method which has been used by my firm for many years is to pass the heated d.c.c. wire through varnish *before* winding, thus ensuring thorough impregnation of the cotton covering throughout the coil, an impregnation which is not always obtained by vacuum impregnation. The finished windings then receive an external coating of varnish. Many motors insulated in this manner are working down wells in India, but perhaps the best proof of the value of this method of insulation was given me some time ago by a client who wrote to say that an open type motor in a colliery owing to an inrush of water was submerged for five weeks in 90 ft. of water. When the pit was unwatered only the eye bolts were visible, the rest of the motor being in a mud bank. The mud was swilled out by a hot water hose and the machine dried out with heater elements without dismantling. The insulation resistance then being 1.2 megohms. The machine was then put to work, and when my client wrote had been running for six months without any trouble.

MAWDSLEY'S LIMITED,
H. ST. HILL MAWDSLEY, *Managing Director.*

Dursley, Glos., *March 30th*, 1931.

Adjustable Resistance for Radio

Mr. H. Bacon's suggestion in your issue of March 13th for using a valve for the purpose of adjustable grid leak rather reminds one of the patent suction pump for removing winkles from their shells and thereby dispensing with the old-fashioned pin. This is, of course, by the way.

My real reason for writing is to point out that according to Mr. Bacon's sketch the auxiliary valve would not operate as a grid leak. The charge which collects on the grid of the main valve is negative, and, as such, cannot pass from the anode to the filament of the auxiliary valve.

Ilford, *March 27th*, 1931. H. W. UNDERHILL.

[Our correspondent does not appear to have read the confirmatory letter on page 534 of our March 20th issue.—EDS. ELEC. REV.]

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1929

26,441. "Asynchronous electric motors." G. Pedrazzo. February 26th, 1929. (Addition to 313,501.) (344,371.)

26,848. "Method of selectively calling wireless stations." Dr. A. Ristow. November 19th, 1928. (344,462.)

29,186. "Apparatus for the complete determination of the direction and strengths of magnetic fields, in particular of the natural magnetic field of the earth." Dr. R. Ambronn. November 30th, 1928. (344,465.)

29,565. "Device for controlling the timbre of sound reproduced by electric means." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 30th, 1929. (344,373.)

32,639. "Automatic control of electric switches." R. J. Aiken. October 28th, 1929. (344,340.)

32,764. "Method for operating electric illuminating tubes." Dr. Z. Bay. October 26th, 1928. (344,439.)

33,060. "Automatic telephone call-box." A. Rogers-Jenkins (P. G. T. de Villars). October 31st, 1929. (344,378.)

35,876. "Electric switches." H. Philpot. January 29th, 1930. (344,535.)

36,068. "Traffic signals." M. L. Knight November 25th, 1929. (344,384.)

36,084. "Electrical indicating or display devices." Automatic Telephone Manufacturing Co., Ltd., and L. M. Simpson. November 25th, 1929. (344,347.)

36,096. "Electric hand lamp." L. Mellersh-Jackson (Burgess Battery Co.). November 25th, 1929. (344,348.)

36,211. "Controllers for periodically closing and opening an electric circuit." General Kontrolar Co., Inc. November 26th, 1928. (344,416.)

36,351. "Systems of ship propulsion." British Thomson-Houston Co., Ltd., R. T. Coe, and F. Fitchett. November 27th, 1929. (344,442.)

36,396. "Distributor for use in telegraphy or the like." Standard Telephones and Cables, Ltd., and E. K. Sandeman. November 27th, 1929. (344,444.)

36,585. "Manufacture or production of covers for electric switches, bell-pushes, ceiling-roses, couplings, and the like, and of analogous articles." J. A. Crabtree. November 29th, 1929. (344,422.)

36,618. "Electrical capacity-controlled apparatus." C. P. Stanworth. November 29th, 1929. (344,445.)

36,646. "Remote metering systems." A. Reyrolle & Co., Ltd., B. H. Leeson, J. A. Harle, and D. E. Lambert. November 29th, 1929. (344,484.)

36,657. "Electric arc rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 29th, 1929. (344,388.)

36,718. "Alternating current electric motors." General Electric Co., Ltd., and N. F. T. Saunders. November 29th, 1929. (344,447.)

36,870. "Electric lighting fixtures." British Thomson-Houston Co., Ltd., and H. C. Wheat. December 2nd, 1929. (344,487.)

36,941. "Thermionic oscillation generators." Standard Telephones and Cables, Ltd. (A. G. Clavier). December 3rd, 1929. (344,448.)

37,017. "Electrical installations for lighting, heating, and like purposes on railway vehicles." J. Stone & Co., Ltd., A. E. Honey, and F. V Abbott. December 3rd, 1929. (344,357.)

37,022. "Ignition devices." British Thomson-Houston Co., Ltd., L. Griffiths, C. J. Morton, and T. H. Woodfield. December 3rd, 1929. (344,360.)

37,058. "Telephone systems." Associated Telephone and Telegraph Co. December 10th, 1928. (Addition to 274,033.) (344,362.)

37,098. "Electric furnaces." P. L. J. Miguet and M. P. Perron. December 6th, 1928. (344,493.)

37,221. "Electric totalisators." Automatic Telephone Manufacturing Co., Ltd., T. G. Rice, and L. M. Simpson. December 4th, 1929. (344,496.)

37,227. "Electric discharge tubes." General Electric Co., Ltd. June 29th, 1929. (344,497.)

37,231. "Luminous electric discharge tubes." General Electric Co., Ltd. July 9th, 1929. (344,397.)

37,318. "Light-sensitive electric cells." British Thomson-Houston Co., Ltd. December 27th, 1928. (344,499.)

37,366. "Venting devices for galvanic batteries." Oldham & Sons, Ltd., and W. D. Wilde. December 5th, 1929. (344,433.)

37,452. "Electrically-operated windscreen wipers for motor vehicles." J. Lucas, Ltd., and S. A. Mason. December 6th, 1929. (344,451.)

37,499. "Apparatus for measuring acoustical impedances." Electrical Research Products, Inc February 19th, 1929. (344,506.)

37,708. "Control desks or panels for electrical systems." A. Reyrolle and Co., Ltd., and C. G. M. Bennett. December 9th, 1929. (344,519.)

37,724. "Locking arrangements for electric light bulbs." J. Stone & Co., Ltd., J. F. B. Widal, and G. M. Boyd. December 9th, 1929. (344,522.)

37,773. "Electric signal transmission systems." Electrical Research Products, Inc. March 29th, 1929. (344,523.)

37,774. "Light valves, particularly for use in recording sound." Electrical Research Products, Inc. January 31st, 1929. (344,524.)

38,100. "Electric cut-out devices for internal-combustion engines." S. Gilchrist. December 12th, 1929. (344,536.)

38,160. "Directional aerial systems." Marconi's Wireless Telegraph Co., Ltd., and F. Woods. December 12th, 1929. (344,539.)

38,206. "Protective boxes for electric cables." T. L. Watkins. December 13th, 1929. (Cognate application, 4,376/30.) (344,540.)

38,358. "Wireless apparatus." C. J. Craker. December 14th, 1929. (344,543.)

38,663. "Electric motor control systems." C. Filmer and Associated Electrical Industries, Ltd. December 17th, 1929. (344,556.)

39,466. "Sparking plugs." Lissen, Ltd., and R. P. Richardson. December 24th, 1929. (Cognate application, 1,591/30.) (344,571.)

39,753. "Instrument transformers." British Thomson-Houston Co., Ltd., B. Withers, and W. S. Adams. December 30th, 1929. (344,575.)

39,905. "Electric incandescent lamps." General Electric Co., Ltd., and A. G. Pearce. December 31st, 1929. (344,577.)

1930

403. "Welding apparatus." British Thomson-Houston Co., Ltd. January 5th, 1929. (344,584.)

878. "Electrical driving apparatus for hosiery machines." Siemens-Schuckertwerke Akt. Ges. February 22nd, 1929. (344,588.)

895. "High-frequency electric machines." C. Lorenz Akt. Ges. January 11th, 1929. (344,589.)

1,748. "Method of, and means for, controlling the motors of electric spinning and doubling machines." H. Schneider. February 2nd, 1929. (Addition to 344,141.) (344,599.)

2,673. "Telephone systems." Siemens Bros. & Co., Ltd., A. T. C. Moore, and D. A. Christian. January 25th, 1930. (344,606.)

2,858. "Means for cleaning accumulator and the like terminals." E. J. Lomas. January 28th, 1930. (344,607.)

2,886. "Control apparatus for electric lifts." Etchells, Congdon & Muir, Ltd., and F. Muir. January 28th, 1930. (344,608.)

3,071. "Incandescent electric lamps." J. Van Eek and H. Fekkes. August 9th, 1929. (344,611.)

3,862. "Short-wave electro-magnetic wave-transmission arrangements." J. J. V. Armstrong (Telefunken Ges. für Drahtlose Telegraphie and W. Ludenia). February 5th, 1930. (344,620.)

4,942. "Terminal connections for multi-core electric cables." G. P. Dennis. February 14th, 1930. (344,629.)

5,337. "Telephone pay stations." Telephon-Apparat-Fabrik E. Zwietusch and Co. Ges. November 14th, 1929. (344,633.)

5,569. "Picture tele-transmission systems, television, and the like systems." Telefunken Ges. für Drahtlose Telegraphie. February 19th, 1929. (344,637.)

7,057. "Electric furnaces comprising a hearth and resistances arranged above the charge." E. F. Russ. March 4th, 1929. (344,662.)

7,487. "Electromagnetic double control valve." J. L. Musgrave and R. Crittall & Co., Ltd. March 7th, 1930. (344,666.)

8,500. "Wireless apparatus." J. P. Laker. March 17th, 1930. (344,677.)

9,431. "Electrodes for electric discharge apparatus." British Thomson-Houston Co., Ltd. March 23rd, 1929. (344,680.)

10,753. "X-ray tubes." Naamlooze Vennootschap Philip's Gloeilampenfabrieken. April 19th, 1929. (Addition to 286,436.) (344,692.)

11,411. "System of generating electrical oscillations." Kolster-Brandes, Ltd. (Kolster Radio Corporation). April 10th, 1930. (344,694.)

12,037. "Cord grips for electric couplings." General Electric Co., Ltd., and F. G. Quance. April 16th, 1930. (344,698.)

12,949. "Electrical accumulators." H. Wehrlin. April 26th, 1930. (344,709.)

13,340. "Automatic train-control systems." General Railway Signal Co. May 16th, 1929. (344,712.)

14,592. "Modulating arrangements for high-frequency transmitters." C. Lorenz Akt. Ges. October 25th, 1929. (344,718.)

15,649. "Apparatus for generating electric current by wind power." A. Beldimano. May 21st, 1930. (344,726.)

17,152. "Television systems." Telefunken Ges. für Drahtlose Telegraphie. June 5th, 1929. (344,736.)

17,482. "High-frequency receivers." Telefunken Ges. für Drahtlose Telegraphie. June 8th, 1929. (344,738.)

17,639. "Multi-core high-tension electric cable, consisting of a plurality of single-core cables, each being encased in a lead sheath." C. Cremer. June 7th, 1930. (344,739.)

19,402. "Modulating arrangements for high-frequency transmitters." C. Lorenz Akt. Ges. December 2nd, 1929. (Addition to 344,718.) (344,747.)

19,515. "Process of, and apparatus for, electrically fine cleaning sulphur-dioxide-containing gases." Lodge-Cottrell, Ltd. (Metallges Akt. Ges.). June 26th, 1930. (344,748.)

20,217. "Line-balancing circuits for two-way transmission systems." Telefonaktiebolaget L. M. Ericsson. July 5th, 1929. (344,752.)

20,917. "Apparatus for the electrical precipitation of suspended particles from gases." Lodge-Cottrell, Ltd. (Metallges. Akt. Ges.). July 10th, 1930. (344,758.)

24,831. "Means for the transmission of selector impulses or the like over phantomed lines." Telefonaktiebolaget L. M. Ericsson. August 20th, 1929. (344,766.)

25,034. "Devices for protecting telephone cords." H. Muller. August 21st, 1929. (344,767.)

38,229. "Loaded submarine cables." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). October 25th, 1929. (Divided application on 342,331.) (344,364.)

38,552. "Electric radiators." Lynn Products, Ltd. July 13th, 1929. (Divided application on 4,199/30.) (344,774.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 25th:—

Miele. No. 517,003. Class 6. Vacuum cleaning machines, electric motors, &c.—Miele Werke Gesellschaft, 29, Carl Miele Strasse, Gutersloh, Westphalia. (British representatives: Wheatley & MacKenzie, 40, Chancery Lane, W.C.2.)

Saracen. No. 516,504. Class 8. Radio-telephonic receiving apparatus and parts thereof.—I. Rich, 65, Lordship Lane, Stoke Newington, N.16.

Tonax. No. 517,524. Class 8. Apparatus for adjusting cone loud-speakers.—A. L. Vandervelde, 5, Guilford Street, W.C.1.

Red Star. No. 519,209. Class 8. Radio-receiving sets, low-frequency transformers, variable condensers, battery eliminators, and gramophones.—Red Star Radio, Ltd., 107-109, Aston Road, Birmingham.

Sashalite. No 520,177. All goods in Class 8.—Sashalite, Ltd., Westminster House, Great George Street, Westminster, S.W.1.

Eta. No. 518,747. Class 8. Thermionic valves and photo-electric tubes.—Compagnie des Lampes, Paris. (British representative: H. Baron, Thanet House, 231, Strand, W.C.2.)

Memajor. No. 519,924 Class 13. Electric switches, fuses, switch fuses, and boxes and casings thereof, distribution panels, junction boxes, electric cable connections and conduits, all being metal goods.—Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.

Omegite. No. 519,857. Class 50. Moulding compositions, being condensation products of phenol and formaldehyde.—British Dyestuffs Corporation, Ltd., Blackley, Manchester.

The South-West E.D.A. Area

The annual luncheon of the South-West Area was held at the Royal Hotel, Bristol, on March 27th, and the chairman (Mr. F. H. Corson, city electrical engineer, Gloucester), presided over a large gathering of the electricity supply industry in the South-Western Area. Sir Henry Hatt (chairman of Bath Electricity Committee) proposed the toast of the Association and made a strong plea for "electrical" education. He emphasised the need of subscription to the Association and remarked that the people who stood aside generally were those who required its assistance most. Propaganda could very well be directed to architects, imparting to them the knowledge that buildings can be very effectively heated by electricity. In replying to the toast, Mr. A. C. Cramb said one of the great factors of E.D.A. was that it was perhaps the only association which contained representatives of every branch of the electrical industry and he considered that a very great achievement. Electricity had sold itself so far but there had been little done in the way of commercial development that was properly organised. There were very few properly qualified salesmen and saleswomen. This was one of the directions in which E.D.A. was endeavouring to be of assistance to the industry. A course of lectures to sales staffs were being organised from which it was hoped a lot of useful information could be imparted. Demonstration houses were being shown and Bristol and Cardiff were to be congratulated on the results obtained from such houses for they had shown the public the service which they were entitled to have. Attention was being paid to schools of domestic science by providing suitable apparatus in order that the cooks of the future might overcome the prejudices of the present-day cook. He urged supply authorities to adopt two-part tariffs, as such tariffs enabled capital charges to be spread over a great number of units and thus the average price was brought down. Lack of uniformity as regarded pressure, frequency tariffs, &c., adversely affected consumers—on these essential things the industry would have to get down to uniformity. Mr. C. W. Sully proposed the "South-West E.D.A. Area," and Mr. F. H. Corson replied.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BALLATER (Aberdeenshire).—Water and filtration works; burgh surveyor.

BARKING (Essex).—Two branch libraries, L.C.C. housing estate; U.D.C. Surveyor. Church, Hewett Road; Bishop of Chelmsford. Shops (14), Longridge Road; Hookers & Rogers.

BASINGSTOKE.—Houses (118) for the T.C.; Middleton & Co., Ltd., builders, Blackpool.

BEXHILL-ON-SEA.—Masonic hall, Wilton Road; G. Cash, Holmesdale Road. Additions to Wilton Court Hotel; Callow and Callow, Endwell Road.

BLACKBURN.—High school for girls, and senior school, Shorrock Lane; J. F. Carr, director of education.

BLACKPOOL.—Shopping centre and Municipal Offices extensions; borough engineer.

BLAYDON-ON-TYNE.—Rebuilding, Station Hotel; H. W Waller, contractor, Back Waller Street.

BOLTON.—Additions to X-ray dept., doctor's house, &c., for Board of Management of Wilkinson's Sanatorium, Whitehill, Sharples; Bradshaw, Gass & Hope, architects, 19, Silverwell Street.

BRIGHTON.—Houses (64), Bevendean estate; Braybons, Ltd. Conversion of Patcham House into flats; borough engineer Café, 13, Grand Junction Road; C. J. Lyst. Alterations, Sherry's, West Street; Ye Mecca, Ltd.

BRISTOL.—Church, Knowle housing estate; Church Extension Committee.

BURNLEY.—X-ray department for the Board of Management of Victoria Hospital (£20,000); Hitchon & Pickup, 46, Manchester Road.

CARLISLE.—Leather works for J. T. Scott & Son, Wigton.

CHELMSFORD.—Extensions, Duke Street; Essex & Suffolk Equitable Insurance Society, Ltd.

CHESTER.—Houses (300), Lache Farm estate; city engineer.

CHESTERFIELD.—Works, with electrical equipment, for Tarmac, Ltd.

CHESTERTON (Cambs.).—Houses (94) for the R.D.C.; Housing Officer, 12, St. John's Street, Cambridge.

CHORLEY (Lancs.).—Additions, Post Office, Corporation Street; H. Ellis.

CHRISTCHURCH.—School for Isle of Ely E.C.; R. D. Robson, education architect, County Hall, March.

COVENTRY.—Extensions, Exhall Infirmary; city engineer.

CROYDON.—Factory and offices, Dingwall Road; H. Berney and Son. Alterations and additions, High Street; Express Dairy Co., Ltd. Alterations and additions, Mayday Road Hospital; H. Berney & Son. Shops, Devonshire Terrace; Burcote, Ltd. Shops, High Street; H. N. Dering. Shops, South End; Morris Estates, Ltd.

DENBIGHSHIRE.—Girls' secondary school (400 places), Wrexham, for the county E.C.; director of education.

DENNY (Stirlingshire).—Houses for the T.C.; J. Strang and Wilson, architects, Vicar Street, Falkirk.

DERBYSHIRE.—Schools, Chaddesden, Spondon, Borrowash, and premises for Clay Cross secondary school, Tipton (£18,000), for the county E.C.

DOVER.—Conversion of Burlington Hotel into flats for Burlington Mansions Co.; C. W. Mason, manager.

ECCLES (Lancs.).—Sewage disposal works extensions; borough engineer.

EDINBURGH.—School (£28,000); city architect.

EPPING (Essex).—Extensions, Empire Cinema, for Mr. Slinger. School extensions, Epping and Maldon, for the county E.C.; J. Stuart, county architect, Chelmsford.

EVESHAM.—Garage and offices, Abbey Road, for the Birmingham and Midland Motor Omnibus Co., 88, Kingsway, London, W.C.2; engineer's office, Omnibus Garage, Bearwood Road, Smethwick, Staffs.

FAVERSHAM.—Houses (136) for the R.D.C.; H. Caffyn, surveyor.

FENTON (Staffs.).—Houses (57), High Street (£21,529); C. Cornes & Son, Hanley.

FLEETWOOD.—Extensions and alterations to branch bank, Ash Street and Warrenhurst Road, for the District Bank, Ltd., 15, Spring Gardens, Manchester; F. Jones & H. A. Dalrymple, architects, 178, Oxford Road, Manchester.

GLASGOW.—Buildings for the governors of the Glasgow and West of Scotland Commercial College (£52,400); J. Millar, architect.

GLOSSOP (Derbyshire).—Reconstruction of Bleach Croft, Charleston Road; J. Walton. Glossop, Ltd. Extensions, West End Central School; borough engineer.

HERNE BAY (Kent).—Alterations, Electric Joinery Works, Beach Street; C. H. H. Kenworthy, Ltd.

HERTFORDSHIRE.—School (434 places), Welwyn Garden City, for the county E.C.; A. E. Prescott, county architect, Hatfield.

HOO (Rochester).—Houses (58) for the R.D.C.; W. J. Stimpson, architect.

HORNCHURCH (Essex).—Houses (114), Stafford Avenue, for Newman, Eyres & Peterson.

HUDDERSFIELD.—Extensions, Moorbottom Ironworks; Lunn and Kaye, architects, Milnsbridge. Shops, for the T.C.; borough architect.

INVERNESS.—Harbour extension scheme (£25,000); clerk to the Harbour Trustees. Rebuilding Theatre Royal, for Miss Graham Falcon.

IRISH FREE STATE (Bray).—Houses (50), Berry's Field and Fair Green; P. J. Meghen, Commissioner, for the U.D.C.

KENT.—Schools, Crayford, Snodland, and West Wickham, for the county E.C.; W. H. Robinson, county architect, Maidstone.

LANCASHIRE.—Senior school, Oswaldtwistle; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

LANCASTER.—Hospital (£50,000); Joint Hospital Board. Central school, Skerton (£21,390), for the E.C.

LEIGHTON BUZZARD.—Factory, Billington Road, for Porubco Hard Courts, Ltd.; A. K. Bamber.

LINCOLN.—Bazaar premises, High Street, for Marks and Spencer, Ltd., London.

LINCOLNSHIRE.—Schools, Alford (£26,250), Ashby (£25,640), Cleethorpes (£30,000), Skegness (£18,000), and Brigg (£18,000), for Lindsey E.C.; director of education.

LIVERPOOL.—Extensions and alterations, Rice Lane, Walton, for Dunlop Rubber Co., Ltd., Fort Dunlop, Birmingham; A. Lakeman, architect, 172, Orphanage Road, Erdington, Birmingham. Extensions to works, Dryden Street, for the Automatic Telephone Manufacturing Co., Ltd., Strowger Works, Milton Road, Old Swan; W. P. Horsburgh, architect, Exchange Buildings, Exchange Street.

LONDON (Hackney, E.).—Library, Englefield Road (£15,654); Hammond & Barr, Ltd., Chelsea, S.W. (Islington, N.).—Rebuilding, Hanover Street School (£30,040); A. Monk, Lower Edmonton, N. (Bermondsey, S.E.).—Flats, Elgar Street, St. Paul's Lane, and Pages Walk; B.C. works manager. (Westminster, S.W.).—Buildings, Northumberland Avenue; Hart and Waterhouse. Building, South Africa House, Trafalgar Square; G. Head & Co. (Soho, W.).—Buildings, Broad Street, Berwick Street, Kemps Court and Hopkins Court, for Midland Shop Properties, Ltd.; Hillier, Parker, May & Rowden. (Ilford, E.).—Houses (158), South Park Drive and Brockham Drive (107); T. Aldridge. Alterations and additions, Cranbrook Road; J. Lyons & Co., Ltd. Nonconformist church and school, Oak Lane; Rawlings, Butt & Bowyer. Additions, Metropolitan Cable Works, Grove Road; F. Smith. United Methodist School, Ilford Lane; Dixon Hall & Co. (Leyton, E.).—Extensions, Mayville Road schools, for the borough E.C.; J. H. Jacques, architect, 61, West Ham Lane, Stratford, E. (Walthamstow, E.).—Extensions, Connaught Hospital (£20,000); secretary. (West Ham, E.).—Central School, Plaistow (520 places), for the borough E.C.; J. H. Jacques, architect, 61, West Ham Lane, Stratford, E. (Greenwich, S.E.).—Vapour baths, &c., for the T.C.; acting borough engineer. (Chelsea, S.W.).—Housing scheme, World's End Passage; borough engineer. (Wandsworth, S.W.).—Baths, Clapham (£64,041), for the B.C.

MANCHESTER.—Two cinemas, Eccles Cross and Bury Old Road, Crumpsall; Drewery & Gomersall.

MANSFIELD.—Re-erection of factory, Sherwood Street, for Ward Bros.

MARKET HARBOROUGH.—Council offices, welfare centre, and library, for the U.D.C.; surveyor.

MINEHEAD (Somerset).—Telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W.

MONTROSE.—Nurses' home (£30,000); Montrose Asylums Board.

NEWCASTLE-UPON-TYNE.—Wesleyan Chapel, West Road; S. Kay, architect, Higham Place. Extensions to J. Lowrie and Co.'s premises; Stockwell & Ditchburn, architects, Pilgrim Street.

NEWTON-LE-WILLOWS (Lancs.).—Labour exchange, for H.M. Office of Works, King Charles Street, London, S.W.

NORTHAMPTON.—Alterations and extensions, West End Cinema (£20,000); P. Thornton, manager. School, St. James', for the borough E.C.; borough engineer.

NORWICH.—Houses (300) for the T.C.; city surveyor.

OTTERBURN (Northumberland).—Conversion of Otterburn Hall into hotel, for Otterburn Hall Hotel, Ltd.; secretary.

PRESTON.—Extension of County Offices; S. Wilkinson, county architect, 16, Ribblesdale Place.

RICHMOND (Yorks.).—Omnibus garage, St. Martin's, for United Automobile Services, Ltd., Kilburn House, Fulford Road, York; G. Shaw, builder.

RIPPONDEN (Yorkshire).—Reinstatement of cotton mills (£10,000); Ripponden Commercial Co., Ltd.

ROCHDALE.—Dormitories at the Rochdale Children's Convalescent Home, St. Annes-on-Sea; W. H. Ashworth & Sons, Ltd., builders. Stanhope Street.

ROMFORD.—Post Office extensions, for H.M. Office of Works, King Charles Street, London, S.W.

SHIPLEY (Derby).—Houses (100); U.D.C. surveyor.